151843

HEALTH AND SAFETY PLAN

SITE PREPARATION AND MATERIAL REMOVAL

PRE-FINAL DESIGN
ENVIRO-CHEM SUPERFUND SITE
ZIONSVILLE, INDIANA

Prepared For:
ENVIRONMENTAL CONSERVATION AND
CHEMICAL CORPORATION TRUST

Prepared By:
AWD TECHNOLOGIES, INC.
INDIANAPOLIS, INDIANA

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NOTICE

This document is a portion of the overall design package and, therefore, cannot be referenced, in whole or in part, as a standalone document for any other purpose.

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ACRONYMS

Personnel

CHSM	Corporate Health and Safety Manager
HSO	Health and Safety Officer
SSO	Site Safety Officer
PM	Project Manager
SM	Site Manager
TL	Team Leader
CO	Contracting Officer
MC	Medical Consultant

Equipment

PID	Photoionization Detector
LEL/O_2	Lower Explosive Limit/Oxygen

Areas

SZ	Support Zone
CRZ	Contamination Reduction Zone
EZ	Exclusion Zone

Manuals

HSP	Health and Safety Plan
APP	Accident Prevention Plan
AMP	Air Monitoring Plan
SDCP	Spill Discharge and Control Plan

Other

ABIH	American Board of Industrial Hygiene
ACGIH	American Conference of Governmental Industrial Hygienists
ARC	American Red Cross
CFR	Code of Federal Regulations
CIH	Certified Industrial Hygienist
MSDS	Material Safety Data Sheets
NIOSH	National Institute of Occupational Safety and Health
OSHA	Occupational Safety and Health Administration
PPM	Parts Per Million
USCG	United States Coast Guard
U.S. EPA	United States Environmental Protection Agency

I have read and concur with this health and safety plan for site preparation and material removal activities for the ECC Site in Zionsville, Indiana.

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AWD Project Manager

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1.0 INTRODUCTION

1.1 Background

This Health and Safety Plan (HSP) has been developed for the site preparation and material removal activities to be conducted at the Environmental Conservation and Chemical Corporation (ECC) Site, located in Zionsville, Indiana. The HSP contains the procedures that are necessary to protect onsite personnel and the general public during this phase of work.

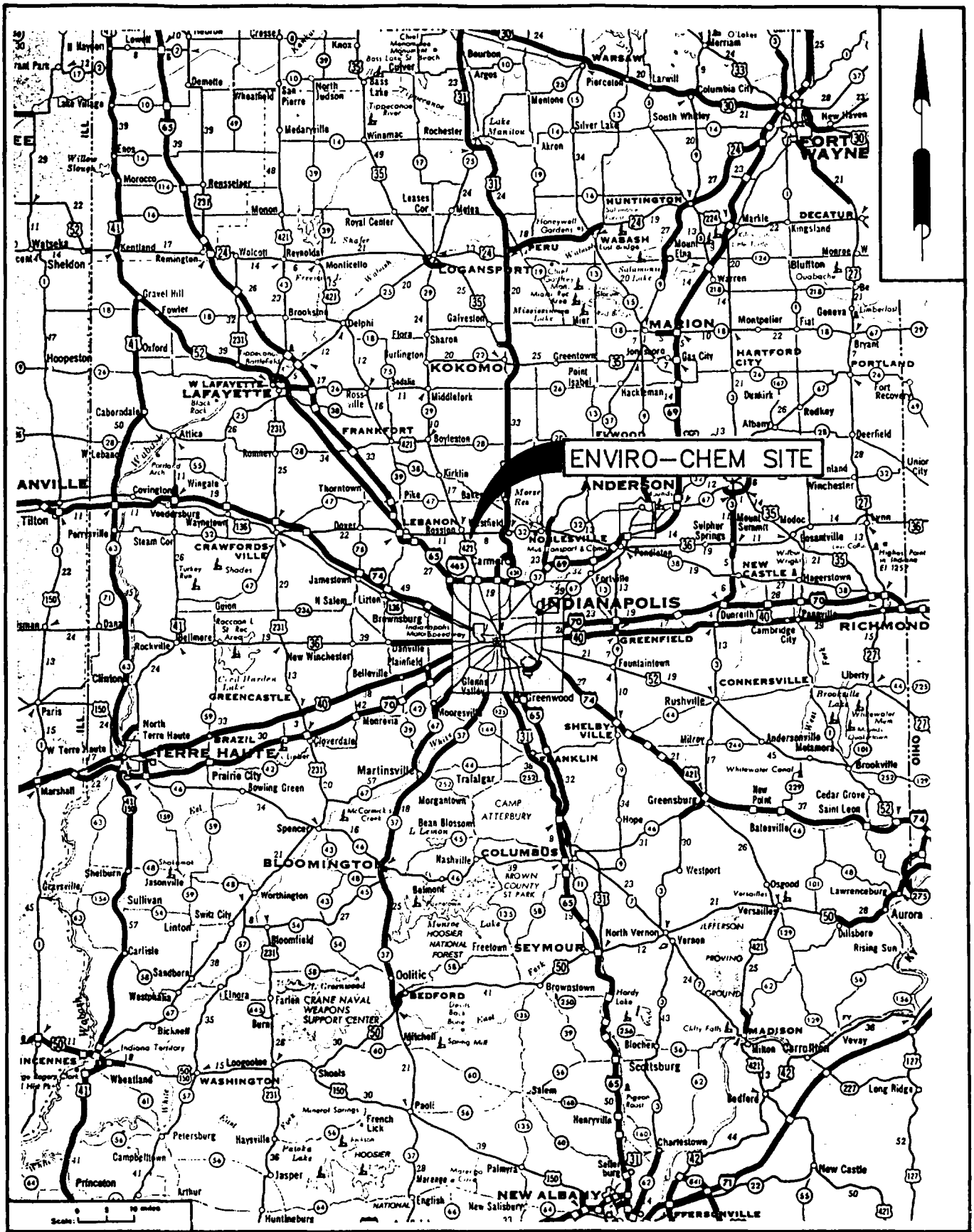
The ECC Site is located in Boone County, approximately 10 miles northwest of Indianapolis, on State Route 421 in Zionsville, Indiana (Figure 1-1). The Site occupies 6.5 acres to the west of the Northside Sanitary Landfill (NSL), a closed solid waste disposal facility. The ECC Site is also bounded on the south and east by NSL property. An unnamed ditch separates the two facilities along the eastern boundary. Several residential homes are located within 1/2 mile of the facility to the north and west (Figure 1-2).

In 1977, ECC began operations at the Site that consisted of the recovery, reclamation, and brokering of primary solvents, oils, and other wastes. Waste products were received in drums and bulk tankers and prepared for subsequent reclamation or disposal. Processes to reclaim solvents and oil included distillation, evaporation, and fractionation.

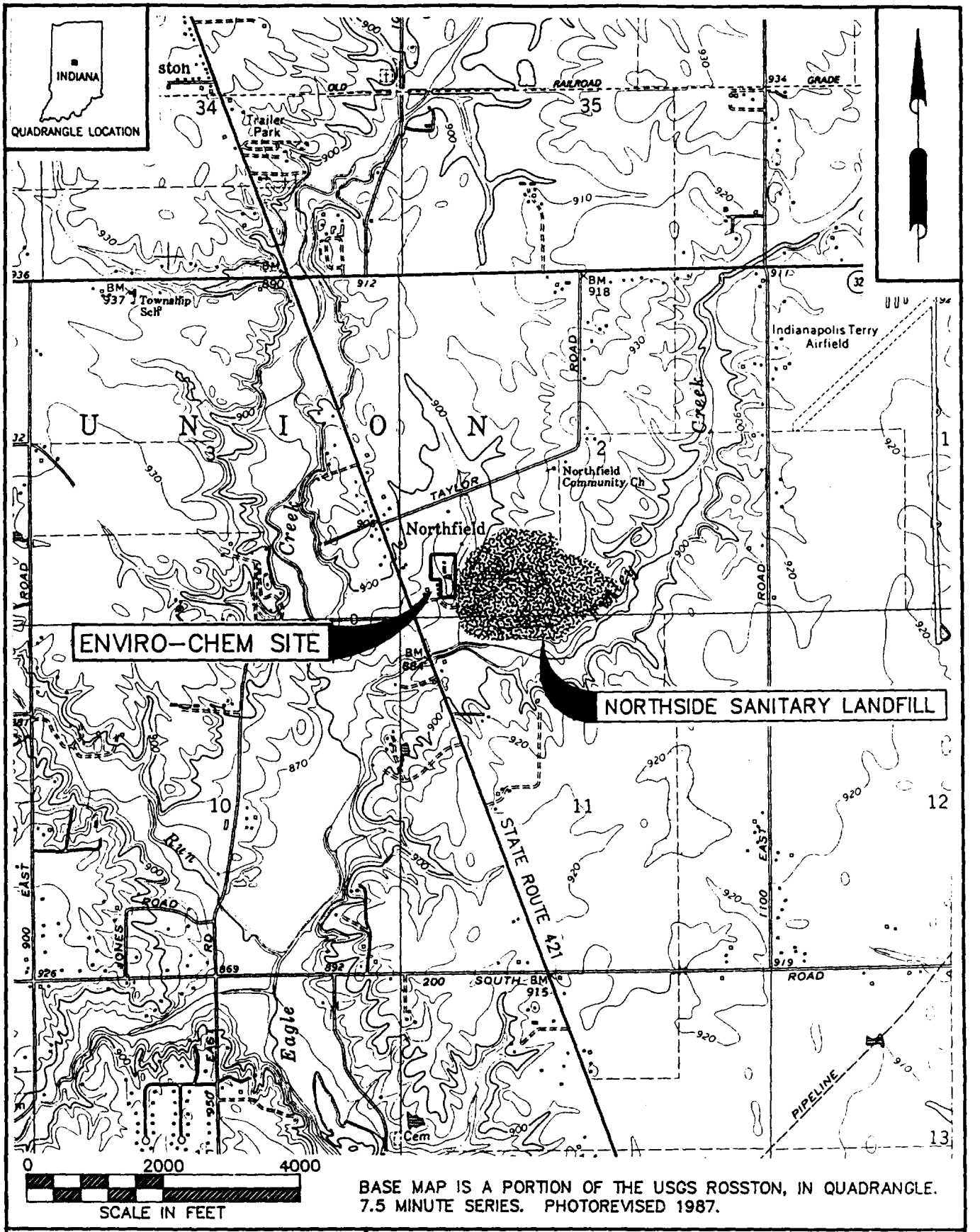
The U.S. Environmental Protection Agency (U.S. EPA) investigations concerning the accumulation of contaminated storm water onsite, improper drum inventory, and several spill incidents lead to civil law suits, and finally the placement of ECC into receivership in July 1981.

Drum shipments to the Site were halted in February 1982. Surface cleanup activities conducted by U.S. EPA contractors during 1983 and 1984 included the removal of cooling pond waters, waste drums, tank wastes, contaminated soil, and cooling pond sludge.

A Remedial Investigation/Feasibility Study (RI/FS) was conducted by CH2M Hill for the U.S. EPA from 1983 through 1986. The Record of Decision (ROD) for the Site was issued on September 25, 1987 and amended on June 7, 1991, and the Consent Decree for remediation of the Site was entered on September 10, 1991.



AWD TECHNOLOGIES, INC AWD TECHNOLOGIES	SITE LOCATION MAP ENVIRO–CHEM SITE, ZIONSVILLE, IN		
	SCALE: AS SHOWN	FIGURE NUMBER 1 – 1	REV 0



BASE MAP IS A PORTION OF THE USGS ROSSTON, IN QUADRANGLE. 7.5 MINUTE SERIES. PHOTOREVISED 1987.

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SITE MAP
ENVIRO-CHEM SITE, ZIONSVILLE, IN

SCALE:	AS SHOWN	FIGURE NUMBER	1-2	REV 0

Remedial activities will include:

- Implementation of access restrictions.
- Demolition and removal of containers and debris from the Site.
- Installation and operation of an in-situ soil vapor extraction (SVE) system.
- Installation of a final cover.
- Monitoring of vapor, subsurface water, soil, and surface water to evaluate the effectiveness of remediation activities.

Although the duration of the remediation is unknown, it is estimated that the construction will take 11 months with the Site Preparation and Material Removal phase lasting approximately 5 months. The SVE system will operate for 1 to 2 years until the site cleanup objectives are met, and long-term monitoring will occur for 7 years.

The objectives of this HSP are to provide safety procedures to be followed during the Site Preparation and Material Removal phase of the remedial activities only, and to establish emergency response procedures for extraordinary conditions that may occur. The contractor(s) performing the other remedial activities will prepare a HSP for their respective activity consistent with the overall HSP.

The procedures presented herein are based on an analysis of site-specific potential hazards and the appropriate protective measures to mitigate these hazards. If hazards arise that are not covered in this HSP, the HSP will be amended accordingly. The health and safety procedures presented in this HSP are in accordance with the appropriate requirements of the U.S. Department of Labor, Occupational Safety and Health Administration (OSHA), and the U.S. EPA.

1.2 Scope of Activities

1.2.1 Explanation of HSP and Contracts

The scope of remedial action activities for the ECC Site is intended to occur in two phases. The first phase, referred to as the Site Preparation and Material Removal Contract, is the extent of work that this health and safety plan applies to. The second phase of work, referred to as the Remedial Action Phase, will occur under a separate contract and health and safety plan.

1.2.2 Scheduled Work for Site Preparation and Material Removal

The general purpose of the first phase of work is to prepare the area for the actual site remediation work.

1.2.2.1 Mobilization

Heavy construction equipment and vehicles, as well as office trailers, will be staged at a remote location offsite in order to begin construction of the support zone.

1.2.2.2 Support Zone

All abandoned vehicles within the support zone area will be removed prior to commencement of work by the owner. Other debris such as concrete rubble and scrap steel will also be removed from the area by the owner.

1.2.2.3 Staging of Tanks

Any tanks that extend into the potential support zone will be moved into the exclusion zone.

1.2.2.4 Support Zone Grading

Once all debris and tanks are removed from the support zone area, grading will begin to allow proper drainage. Several culverts may be placed in offsite drainage ditches in order to facilitate proper flow.

1.2.2.5 Development of Support Zone and Fencing

Once the support area has been graded, gravel will be placed throughout all occupied areas of the support zone. Office trailers, including a personnel decontamination trailer and storage trailer, will be placed and utilities will be connected. Activation of access/egress restrictions will occur thereafter. A fence will be installed between the exclusion zone and the support zone inhibiting personnel access/egress except through the personnel decontamination trailer. Vehicle traffic will enter and exit through their respective gates and decontamination area. A permanent security fence will be installed around the ECC Site perimeter and support zone. Internal access will only be possible during hours of operation.

1.2.2.6 Construction of Vehicle and Tank Decontamination Pad and Water Storage Pad

A concrete pad will be constructed for vehicle and tank decontamination in the contamination reduction zone. A concrete pad will also be constructed for storage of clean water and spent decontamination water awaiting disposal.

1.2.2.7 Tanks

There are 53 steel tanks that will be removed from the exclusion zone. They will be placed on the tank decontamination pad, rinsed off, and scanned with a PID externally and internally. An LEL/O_2 meter will also be used for internal monitoring prior to cutting any tank. Initial scanning of the tanks with a PID and LEL/O_2 during a field investigation in November 1992 found no readings that would inhibit hot methods of tank cutting. Therefore, no elevated readings are anticipated during tank demolition. Once instrumental readings indicate a safe atmosphere for cutting, the tank will be cut so that internal decontamination may be completed. Once visually clean, the tank will be taken to the laydown area and cut for disposal.

1.2.2.8 Drums

All drums onsite will be staged in a designated area according to their condition. The drums will be opened and the contents placed in their respective areas: soils will be placed in an open top rolloff box onsite that can be covered with a tarpolin and stored until Phase II activities. Chemical protective clothing will be placed in a hazardous waste rolloff box which will be removed to a disposal facility. Non-treatable liquid in drums will be bulk stored and taken to

a hazardous waste disposal facility. Other miscellaneous debris in drums will be disposed of in the solid hazardous waste recepticle with the chemical protective clothing. The drums will then be crushed and disposed.

1.2.2.9 Miscellaneous Debris

All miscellaneous debris scattered about the Site (see Appendix A of the Specifications for Quantities and Classifications) will be disposed.

1.2.2.10 Buildings

Once all potentially hazardous materials are removed from the process building and A-frame house, they will be demolished into piles of rubble and disposed.

1.2.2.11 Conclusion of Activities

Phase I, Site Preparation and Material Removal, will be considered complete once all above ground obstructions have been removed. The Site will be ready for Phase II activities including soil vapor extraction, trenching and pipe installation, installation of monitoring wells, and finally a clay cap over the Site. Phase I activities are expected to occur over a period of approximately 5 months.

2.0 CONTRACTOR ORGANIZATION AND RESPONSIBILITIES

2.1 General

Health and safety is a line management responsibility; and as such, the Project Manager (PM) is responsible for the overall direction, implementation, and enforcement of health and safety for the project. Daily implementation and enforcement of the HSP during field activities will be directed by the Site Manager (SM). The SM will be technically assisted in this function by the SSO. SSO's main function is to serve as a technical advisor to line management in matters regarding health and safety. The SSO will primarily be responsible for the technical and administrative functions relative to health and safety necessary during onsite activities. Additionally, although health and safety is a staff function, the SSO has the authority to stop work if an "imminently dangerous" situation exists. Such a situation will be immediately reviewed by the PM and SM, and the Corporate Health and Safety Manager (CHSM). From a technical standpoint, the SSO will report to CHSM, who is a Certified Industrial Hygienist in Comprehensive Practice, and as such, will serve as the HSO for this project.

All other personnel working on the Site will report to the SM and ultimately the PM and, in keeping with OSHA requirements and management principles, are required to comply with all procedures outlined in this HSP.

2.2 Overall Management Responsibilities

The responsibilities of the Project Manager, Site Manager, Health and Safety Officer, and the Site Safety Officer are as follows.

2.2.1 Project Manager

The Project Manager (PM) is the overall manager of the project. The PM has the following responsibilities:

- To see that the project is performed in a manner consistent with the Corporate Health and Safety Program.
- To have a Health and Safety Plan prepared and approved.
- To provide the Project Health and Safety Officer with project information related to health and safety matters and development of the HSP.
- To implement the HSP.
- To monitor compliance with the HSP by respective company and subcontractor personnel.

The PM has the authority to take the following actions:

- To determine personnel assignments on this project.
- To temporarily suspend field activities, if the health and safety of personnel are endangered, pending further consideration by the Health and Safety Officer.

2.2.2 Site Manager

The Site Manager (SM) is the appointed manager of the project on the Site. The SM is also referred to as the Construction Manager for purposes of onsite remedial construction. The SM is responsible for the general oversight of the progress of onsite activities, including the management of all onsite field personnel, and for implementing actions to ensure compliance with the HSP.

The SM is responsible for:

- Coordinating and providing the necessary labor and materials for the implementation of the HSP.

- Actively supporting jobsite safety by including safety as a part of pre-job planning and scheduling.

- Evaluating job specifications for potential safety and health hazards and review with the safety representatives.

- Communicating jobsite safety and health control measures among contractors and employees.

- Actively supporting and participating in the implementation of the Safety Program pertaining to company employees.

2.2.3 Health and Safety Officer

The Health and Safety Officer (HSO) is responsible for the preparation of the HSP. The HSO is also responsible for assisting the PM in implementing and enforcing the HSP. Specific responsibilities include:

- Conducting the initial site-specific health and safety orientation meeting and providing support for additional meetings as periodically required.

- Providing support for all onsite health and safety activities as needed and shall be responsible for decision-making involving the upgrade or downgrade in personal protective equipment.

- Establishing new health and safety measures as appropriate based on changing conditions.

- Maintaining all related health and safety documentation, including, but not limited to, employee medical qualifications, respirator fit tests, medical surveillance, and field monitoring results.

- Authority to stop work if conditions are deemed unsafe.

- Authority to temporarily remove an individual from the Site if he/she is not complying with the HSP protocols.

2.2.4 Site Safety Officer

The Site Safety Officer (SSO) is responsible for providing technical guidance to the Site Manager on matters pertaining to health and safety. The SSO's primary responsibility is to assist the SM in the implementation and enforcement of the HSP.

Specific duties of the SSO include, but are not limited to:

- Monitoring compliance with the HSP.

- Coordinating and conducting onsite safety briefings for all site personnel.

- Managing health and safety equipment (respirators, instruments, boots, gloves, suits, etc.).

- Coordinating and performing air monitoring with the HSO as specified in the HSP.

- Establishing work/rest regimen in conjunction with the Site Manager (i.e., heat stress/cold stress monitoring).

- Helping establish emergency response provisions with local authorities (e.g., hospital, fire, and police).

- Continuously monitoring health and safety conditions during the implementation of the site work.

- Maintaining site safety field logs to record air monitoring results, weather conditions, employees onsite, safety problems, and other related information.

- Reporting all incidents to the HSO.

- Stopping work if conditions are deemed unsafe; also to temporarily remove an individual from the Site if he/she is not complying with the HSP. In both cases, the SSO will confer with the HSO and SM regarding the followup actions; the presence of an SSO will not abrogate safety responsibilities of other personnel.

- Daily safety inspections of work areas.

3.0 MEDICAL MONITORING

3.1 Medical Surveillance Requirements

Prior to performing any work in a project exclusion zone or contamination reduction zone, all site personnel must successfully complete an entry medical examination or demonstrate that they currently participate in a regular medical monitoring program which satisfies project-specific guidelines and the OSHA requirements of 29 CFR 1910.120(f). Subcontractors involved in field activities must provide documentation of medical examinations for their employees.

All personnel hired specifically for the work in the exclusion or contamination reduction zones at this Site who are not included in a medical monitoring program that meets the requirements of 29 CFR 1910.120 must receive entry and exit examinations and 12-month interval examinations during work at the Site. Any personnel who participate in an existing medical surveillance program will continue in their program for the duration of site work.

The minimum acceptable medical examinations for this project include:

- Past Medical History - On entry to the program, information concerning past occupational and personal as well as family history of disease
- Present Medical Profile - All pertinent medical information regarding present state of health and during each year of field work in hazardous material projects
- Exposure History - Information concerning the cumulative duration of time spent on potentially hazardous sites, the primary toxic substances, and the levels of protection employed by each Site
- Laboratory Analyses - Hematology, liver and kidney function tests, and urinalysis
- Physical Examination
- Hearing Test

- Vision Test

- Pulmonary Function Test

Optional tests, if recommended by the examining physician include:

- Electrocardiogram
- X-ray
- Special Tests - Medical information concerning the effects of exposure to specific contaminants

All hazardous waste employee physician approval forms will be kept in a health and safety file onsite. In addition to the approval forms, medical data forms for all personnel will also be kept on file.

4.0 EMPLOYEE, SUPERVISOR, AND VISITOR TRAINING

All personnel must meet health and safety training regulations outlined in 29 CFR 1910.120(e). This will primarily involve exclusion zone and contamination reduction zone workers; hence 40-hour introductory, refresher, and supervisory training requirements for supervisory personnel will apply. There may be site visitors who fall under OSHA's 24-hour training provisions, and any decision regarding applicability of these provisions will be made by the HSO.

To comply with OSHA's site-specific training requirements, the HSO will conduct a training session immediately preceding field activities. This training will be attended by applicable personnel and will address HSP elements, integrated with any other applicable requirements. Any need for additional site-specific training due to changes in the work force will be conducted by the SSO. The SSO will also be responsible for safety training for onsite personnel and "visitor" briefings.

4.1 Site-Specific Training

The content of the site-specific training program, which will include instructions concerning potential hazards, is outlined below:

- Introduction to the hazardous materials previously identified at the Site
  - Definition of hazardous materials
  - Classification of hazardous materials
  - Potential for ignitability, corrosivity, reactivity, and/or toxicity
  - Possible radiological hazards
- Toxicological impacts of possible contaminants
  - Expected exposure levels
  - Routes of probable exposure
    - -- Respiratory tract
    - -- Dermal penetration
    - -- Ingestion

- Expected toxic effects
- ACGIH threshold limit levels
- Carcinogens

- Emergency planning and principles to be used on the job site

  - Emergency medical care and treatment
  - General safety practices
  - Emergency telephone numbers
  - Onsite communications
  - Names and responsibilities of key project safety personnel

- Respiratory protection level used onsite

  - General principles
  - Potential hazards
  - Protective measures provided by air monitoring
  - Response (evacuation) requirements activated by abnormally high volatile organics in ambient air

- Protective clothing requirements

  - Level of protection
  - Articles of protective clothing
  - Purpose of each article of protective clothing
  - Proper use of protective clothing

- Decontamination

  - Concern regarding proper decontamination
  - Extent of decontamination required
  - Personnel decontamination under normal conditions
  - Personnel decontamination during medical emergencies
  - Decontamination of equipment
  - Disposal of contaminated materials

Personnel will be required to sign a document at the conclusion of the training program stating that they understand and will abide by the provisions found in this HSP.

4.2 Daily Safety "Tailgate" Meeting

Each day prior to the start of work activities, all site personnel will meet and sign an attendance sheet. At this time, the SSO will indicate the work scheduled for the day and what level of protection will be required. Also, any need for changes in safety procedures will be addressed. The crews will be asked to discuss any concerns they have regarding health and safety.

All topics covered in the meeting will be documented and posted for the day in the safety office.

5.0 HAZARD ASSESSMENT

5.1 Chemical Hazards

Previous site investigations have indicated the presence of chlorinated volatile organic compounds (VOCs) in the subsurface water below the ECC Site. These compounds include, but are not limited to, 1,1,1-trichloroethane, trichloroethene, tetrachloroethene, chloroform, and methylene chloride.

Because most of the contaminants detected onsite have relatively high vapor pressures, the primary exposure pathway during field activities will be via inhalation. However, a potential dermal contact exposure pathway will exist during remedial activities. The ingestion of contaminants is not likely if normal precautions concerning personal hygiene are followed.

Appendix A illustrates the chemical, physical, and toxicological properties of the contaminants of concern on this project.

In addition to the inhalation and dermal pathways, other exposure pathways are potential hazards to onsite personnel. Although they are less hazardous than the inhalation and dermal contact routes, precautions should be taken to avoid the following potential exposure pathways:

- Ingestion of contaminated subsurface or surface water
- Ingestion of contaminated surface soil
- Eye contact with any contaminated materials

To mitigate these potential hazards, a thorough program of personnel decontamination and hygiene will be maintained during remedial activities. Also, splash protection (e.g., goggles, rubber boot covers, and chemical resistant gloves) will be used during the sampling or handling of any contaminated liquids and during steam cleaning. Details on personal protective equipment and procedures are provided in Section 7.0 of this HSP. Specific steps for decontamination of equipment are included in Section 9.0.

5.1.1 General Description of Chemical Hazards

Halogenated Hydrocarbons: Vapor inhalation toxicity increases in the order fluorinated, unhalogenated, chlorinated, brominated, iodinated. All cause narcosis. Many sensitize the heart to epinephrine (adrenaline). Thermal decomposition produces hydrohalic acids.

Methylene Chloride is a colorless liquid with a penetrating ether-like odor that is irritating at high concentrations. Forms flammable vapor-air mixtures. Open flames and welding arcs can cause thermal degradation with the evolution of hydrogen chloride and very small amounts of phosgene and chlorine.

1,1,1-Trichloroethane is a suspect carcinogen, poisonous by ingestion, intravenous, and subcutaneous routes. This compound is moderately toxic by inhalation, skin contact, and intraperitoneal routes. An eye and severe skin irritant. Has narcotic properties and acts as a local irritant to the eyes, nose, and lungs. It may be injurious to the liver and kidneys.

Chloroform is a confirmed carcinogen, and a human poison by ingestion and inhalation. Moderately toxic experimentally by intraperitoneal and subcutaneous routes. Produces systemic effects by inhalation: hallucinations and distorted perceptions, nausea, vomiting, and other unspecified gastrointestinal effects.

Trichloroethene is a suspected carcinogen, and is an experimental poison by intravenous and subcutaneous routes. Moderately toxic by ingestion and intraperitoneal routes. Mildly toxic by ingestion and inhalation. An eye and severe skin irritant. Inhalation of high concentrations causes narcosis and anesthesia. A form of addiction has been observed in exposed workers. Prolonged inhalation of moderate concentrations causes headache and drowsiness.

Tetrachloroethene is a confirmed carcinogen, and an experimental poison through intravenous route. Moderately toxic by inhalation with the following effects: local anesthetic, conjunctiva irritation, general anesthesia, hallucinations, distorted perception, coma, and pulmonary changes. Moderately toxic by ingestion, inhalation, intraperitoneal, and subcutaneous routes. May cause reproductive failure. An eye and severe skin irritant. Liquid can cause injuries to the eyes.

Symptoms of acute intoxication from this material are result of effects upon the nervous system. Can cause dermatitis. Irritates the gastrointestinal tract upon ingestion.

5.2 General Physical Hazards

The Contractor will be required by this HSP to develop an activity hazard analysis which will indicate the hazards associated with all phases of work activities onsite. The analysis will include but not be limited to the following sections:

5.2.1 Trenching

A main concern for the construction phase of the project is the hazard of trenching and working within a trench. For this reason, OSHA regulations have been included in this HSP (see Appendix H) for review by personnel working within a trench or in close proximity to a trench. The potential for trench cave-in is very likely. The most obvious result to victims involved in cave-in occurrences is death. Therefore, all safety precautions and OSHA regulations will be strictly adhered to. Specific methods of engineering practices, i.e., shoring, sloping, will be put forth in the project specifications to ensure OSHA guidelines are followed. A comprehensive checklist is included in Appendix F.

5.2.2 Heat Stress

Heat stress may be of concern depending on the ambient temperature and type of protective clothing required during site activities. Impermeable protective clothing, such as chemical-resistant coveralls, will reduce the body's ability to dissipate heat, thus increasing the chance of heat-related problems.

Heat exhaustion is a response to heat characterized by fatigue, weakness, and collapse because of the inadequate intake of water to compensate for loss of fluids through sweating. Heat stroke is a response to heat characterized by extremely high body temperature and disturbance of the sweating mechanism. Heat stroke is an immediate, life-threatening emergency for which medical care is urgently needed.

One or more of the following control measures will be used to control heat stress:

- Employees will be informed of the symptoms of heat stress and heat exhaustion.
- An adequate supply of cold water or a commercial mix, such as Gatorade, will be provided to all employees.
- Employees involved in work tasks requiring the use of impermeable clothing will be required to take periodic breaks.
- All breaks will be taken in a shaded area where employees will be required to remove impermeable protective garments during rest periods.
- All employees will follow Contractor SOPs.
- All employees will be informed of the importance of adequate rest, replacement of lost body fluids, and proper diet to prevent heat stress.
- All employees will be monitored for heart rate and body weight changes which may indicate that more frequent breaks and/or more fluid intake is required.

5.2.3 Cold Stress

Cold weather exposure is an occupational stress of concern. Several factors influence the development of a cold weather related injury: (1) ambient temperature, (2) wind velocity, and (3) the presence of moisture. The following precautions will be used to avoid potential frostbite injuries or hypothermia during the field activities:

- Cold weather exposure hazards will be discussed during the safety training program covered prior to the initiation of field activities.
- Thermal socks, thermal underwear, hard hat liners, or other cold weather gear will be provided to employees.

- Periodic breaks will be required during cold weather field activities and warm drinks will be provided.

- Employees who become wet from perspiration or precipitation will be instructed to change clothes.

- Employees will be instructed to recognize the symptoms of exposure and frostbite.

- All employees will follow Contractor SOPs.

5.2.4 Slips, Trips, and Falls

There is a risk of injuries resulting from falls, tripping over tools or equipment, slipping on wet surfaces, or exposure to noise in excess of acceptable limits. Field personnel will be made aware of the fact that protective apparel and equipment may limit visibility, hearing, and manual dexterity. Personnel will be made aware of potential hazards onsite in the tailgate meetings.

5.2.5 Electricity

During any field activities which involve work around live utilities, a potential exists for the machinery involved to come in contact with energized sources. The results of this could lead to fire/explosion and/or electrocution. Additionally, personnel could come in contact with energized parts of machinery causing electrocution. Control efforts for these hazards include requirements that machinery onsite be properly maintained, positioned, guarded, and operated by competent personnel. No equipment shall be permitted within a 20-foot radius of energized sources with nominal voltage below 300 kV. Any areas targeted for subsurface investigations shall first be investigated to determine the presence of underground utilities. A representative of the utility commission is to clear any location prior to the commencement of any subsurface activities by contractors. Documentation with respect to this clearance is to be recorded in the appropriate TL's logbook. Additionally, all electrical power sources utilized during construction will have ground-fault circuit interrupters or the Contractor will have an assured equipment grounding program.

5.2.6 Heavy Equipment

Considerations for controlling the movement of personnel and equipment in a construction area are vitally important to any project, as injuries may occur while working with or adjacent to such equipment. This category can include moving heavy equipment and cranes and hoists, which present the potential hazards of snapping cables, sling, and ropes. The following controls, in addition to relative standard operating procedures, will be implemented during the entire project:

- Workers shall adhere to all applicable standards and regulations for performing construction/removal work (29 CFR 1926, etc.).
- Operators will be trained and experienced in the use of their equipment.
- Equipment shall be properly guarded.
- Equipment will be checked on a daily basis for "roadability."
- Signals will be given to the operators of both equipment and vehicles in any work area by one designated person.
- All personnel will stay a minimum of 2 feet clear of the operational area of the equipment.
- No personnel will stand directly underneath any load or piece of equipment, i.e., manlift, backhoe bucket, etc.
- Any unsafe equipment will be removed from service until safety defects can be corrected. Equipment shall be shut down and locked out before maintenance is begun.
- Equipment operators will not leave their machine unattended while it is running.
- All equipment will have electronic backup alarms.

- The speed limit on the Site will be 10 miles per hour (mph) for all vehicles.

- No vehicles or equipment will be operated in a careless or unsafe manner.

- Personnel will wear appropriate PPE when working with heavy equipment. Dermal protection must fit properly and be taped to prevent "caught on" or "caught between" hazards.

5.2.7 Lifting

Improper lifting techniques can lead to back strain and/or related injury. During lifting tasks, personnel are to lift with the force of the load suspended or distributed on their legs and not by their backs. Additionally, the appropriate number of personnel must be used when lifting or handling heavy equipment. These procedures are to be implemented to minimize the potential for back strain.

5.2.8 Noise

Certain operations involving heavy equipment may present noise levels exceeding the OSHA Action Level of 85 dBA and possibly the OSHA PEL of 90 dBA. Hearing protection will be available during site activities and the SSO will evaluate the need to wear this protective gear based on sound level measurements and noise dosimetry. Refer to state OSHA requirements for different action levels.

5.2.9 Weather

Weather-related hazards include heat, cold, rain, snow, electrical storms, etc. All of these hazards will typically correlate to the season in which field activities occur. No outside work will occur during electrical storms. Work cessation due to other adverse weather conditions will be at the discretion of the SM and SSO.

5.3 Biological Hazards

Numerous types of pest organisms may be present depending on the time of year, including mosquitos, snakes, and ticks. Field personnel are encouraged to use insect repellents when mosquitos and ticks are present. To avoid snake bites, personnel will check the ground for snakes before walking through grassy or debris strewn areas. A first-aid kit and insect repellent will be available for use in the field. In many parts of the United States, tick-borne diseases pose a significant health risk during warm months. Personnel are advised to check themselves periodically throughout the day, and thoroughly as they shower at the end of the day. Report any snake or tick bites to the SSO.

Poison ivy may also be evident in the general work area. All personnel should be made aware of what the rash-producing plant looks like so as to avoid any contact either on skin or clothing. If contact is made on the skin, wash the area immediately with soap and water. If irritation persists, contact the SSO.

5.4 Radiological Hazards

Reports indicate during the early 1970s that 20,000 pounds of waste was shipped to the ECC Site from facilities under control of the Department of Energy which may have contained low level radiation not exceeding 0.001 millicuries. It is expected, however, that all of the waste was removed during the initial Phase I emergency cleanup, and that no remains exist onsite. During a site investigation of surface debris in November 1992 by AWD, no indications of radiation were detected. For this reason, no encounters with radioactive material are expected during site preparation and material removal activities.

6.0 SITE CONTROL MEASURE

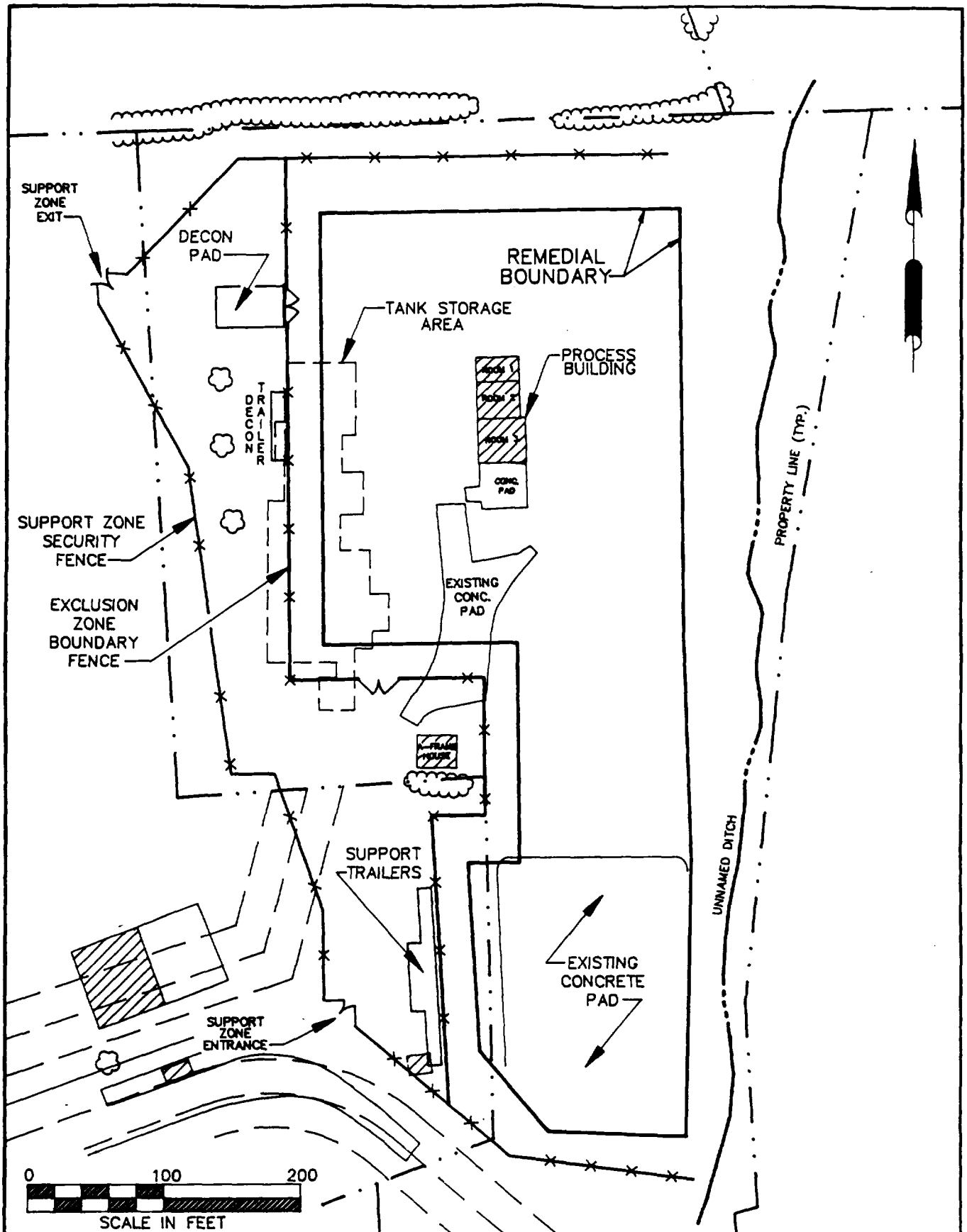
6.1 Work Zones

The exclusion zone (EZ) will be designated as the specific location where work activities occur, i.e., drum handling, demolition, etc. The EZ will be physically barricaded by means of temporary cyclone fencing which will serve as a barrier to personnel indicating the need to wear personal protective equipment (PPE) in the work area (see Figure 6-1). The work zone will encompass the entire ECC Site with the exception of the support zone.

The support zone, where support facilities (i.e., office trailers and vehicles) will be located, will be in a controlled area on the property. This zone will be in an area where no contamination has been identified. Personnel exiting any designated exclusion zone will be required to go through the prescribed level of decontamination before entering any support area. Additionally, the storage of any contaminated materials in the support zone will be prohibited.

Decision-making criteria for each work area setup takes into account the following:

- Site historical information
- Suspected dimensions of the contaminated area
- Physical and topographical features of the Site
- Weather conditions
- Access requirements
- Physical, chemical, toxicological, and other characteristics of the substances present
- Cleanup activities required
- Potential for fire
- Area needed to conduct operations
- Decontamination procedures
- Potential for exposure



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PROPOSED BOUNDARIES OF SUPPORT ZONE AND EXCLUSION ZONE

ENVIRO CHEM SUPERFUND SITE — ZIONSVILLE, IN

CLIENT: ENVIRONMENTAL CONSERVATION & CHEMICAL CORP. TRUST — JOB NO. 2259-553

SCALE: AS SHOWN — FIGURE NUMBER 6-1 — REV 0

FILE: \ECC\FIG6-1.DWG

The three-zone approach assumes that an appreciable exposure scenario exists. In situations involving negligible exposure potentials (i.e., surface activities), site zoning procedures may be modified following approval of the SSO. In all instances, applicable information will be appropriately communicated to personnel.

No employees will be permitted to enter any exclusion zone or any other area where there is a potential for chemical exposure unless they have the appropriate medical clearance, training, and PPE. Keeping current medical and training documentation onsite will enable the SM and SSO to ensure that unauthorized personnel do not enter a restricted work area. Each SM will be responsible for identifying and controlling the personnel and equipment in their respective work area. This will be accomplished via daily logbook entries. Additionally, all personnel passing through the decontamination trailer (entering the controlled area of the Site) will sign a daily tracking sheet indicating their entrance into the controlled area. All exclusion zone work shall require that the buddy system be used.

6.2 Markings/Signs

The following markings/signs will be used as visual indicators:

- Exclusion Zone Marking

  The outer limits of the work zone will be indicated by cyclone fencing. Signs shall be posted along the perimeter (i.e., Hazardous Area - Keep Out), as per 29 CFR 1910.145.

- Equipment

  Equipment and vehicles entering the exclusion zone shall remain inside EZ limits until decontamination is accomplished and the item has been cleared to leave the Site.

6.3 Communications

Onsite communications will consist of two-way radios operating on a single frequency that will be carried by the SM, SSO, and the TL or foreman of each work crew. A "base station" will be monitored by personnel in the support trailer in the event that an outside emergency agency needs to be notified immediately by telephone.

Emergency telephone numbers and reporting instructions for ambulance, hospital, fire, and police shall be available at the Site. All field personnel shall be briefed concerning the people and equipment to be contacted during an emergency.

An internal communication system consisting of hand signals as well as voice communication shall be adopted by field personnel because of potentially noisy working conditions at the Site. The hand signals suggested to be used during field operations are:

- Hand gripping throat - out of air, can't breathe
- Grip partner's wrist - leave area immediately
- Hands on top of head - needs assistance
- Thumbs up - OK, I am alright, I understand
- Thumbs down - no, negative

6.4 Security

Security procedures will be under the direction of the SM.

The exclusion zone perimeter will be secured by cyclone fencing. No entry by unauthorized personnel will be permitted. The contamination reduction zone and support zone will be established within a fenced-in area, however, access will be possible during working hours from the support zone. A gate to the support zone will be locked at the end of the workday. No further security measures are anticipated.

7.0 PERSONAL PROTECTIVE EQUIPMENT

7.1 General

Although certain engineering and administrative controls, as discussed in other sections of this HSP, will be instituted during site activities, personal protective equipment (PPE) will be used as the primary measure to minimize personnel exposure to hazardous materials. Decision-making criteria for PPE requirements include:

- Historical information
- Known/suspected contamination
- Work location/duration
- Task being performed/method of operation
- OSHA requirements
- Other requirements as directed by applicable regulations

Throughout the course of activities, PPE requirements may need to be modified (upgraded or downgraded) due to environmental concerns/site conditions (i.e., dusty conditions, visual contamination, exceeding monitoring instrument action levels) and/or if additional analytical data becomes available which suggests an increased or decreased level of hazard. All modifications will be directed by the SSO with approval from the HSO.

OSHA requirements (29 CFR 1910.120) dictate that when PPE is used, a PPE program be developed (see Appendix B). Similarly, separate requirements are dictated by OSHA for respiratory protection. However, it is realized that there is much overlap between PPE and respiratory protection, since respiratory protection is in fact a facet of PPE. To address these OSHA requirements, a site-specific approach to these programs recognizes that PPE/respiratory requirements are dynamic and may vary from project to project. It must be understood, however, that PPE and the Respiratory Protection Program (RPP) (see Appendix C) directly interface as previously stated.

7.2 General Levels of Protection

Potential hazards will be reduced by protecting against exposures to hazardous materials by using appropriate personal protective equipment.

7.2.1 Respiratory Protection

The primary respiratory protection expected to be used are full-faced air purifying respirators equipped with combination organic vapor/HEPA cartridges for removing organic vapors, dusts, mists, and fumes. The respiratory protection program shall follow the OSHA guidelines in 29 CFR 1910.134. The guidelines to be followed when using Level C respiratory protection include:

- Air purifying cartridges will be replaced at the end of each shift or as needed.
- Only employees who have had a pre-issue qualitative fit test will be allowed to work under Level C respiratory protection.
- Employees will have been instructed and trained in the proper use of respirators and their limitations.
- Only employees who have passed a medical examination, including a pulmonary function test, will be allowed to use Level C respiratory protection.
- Conditions that prohibit a proper seal between the respirator and face (e.g., facial hair, eyeglasses with earpieces, etc.) will not be allowed. The wearer should check the facepiece fit every time he or she puts on the respirator.
- Respirators shall be regularly cleaned and disinfected.
- Respirators used routinely will be inspected during cleaning and worn or deteriorated parts will be replaced.
- Respirators will be stored in a convenient, clean, and sanitary location.

7.2.2 Summary of PPE Required per Task

The following table illustrates the minimum level of PPE required for each activity identified in this HSP. Table 7-1 provides a description of the individual items required for each level of protection. Section 8.3 provides the decision logic (Action Levels) for upgrading and/or downgrading the initial level of protection.

Task	Initial Levels of Protection	Potential Levels of Protection
Mobilization	D	D
Setup of Equipment/Support Zone	D	Modified D; D
Earth Handling Activities/Trenches Inside Remedial Boundary	C	B; C; Modified D
Offsite Trench Construction	D	B; C; Modified D
Drum Handling	C	B; C; Modified D
Building Demolition	Modified D	Modified D
Tank Handling	Modified D	C; Modified D
Decontamination	C	C; Modified D
Demobilization	D	D

TABLE 7-1

PERSONAL PROTECTIVE EQUIPMENT

PPE Required	Levels of Protection				
	D	Modified D	C	Modified C	B
Job Issue Cotton Coveralls	X	X	X	X	X
Eye Protection Meeting ANSI Z87.1	X	X			
Hard Hat	X	X	X	X	X
Steel Toe Boots	X	X	X	X	X
Tyvek/PE Coveralls		X	X		X
Rubber Boots/Boot Covers		X	X		X
Inner Surgical Gloves (Latex/Nitrile)		X	X		X
Outer Nitrile Gloves		X	X		X
Full Face Respirator w/GMC-H* Cartridges			X	X	
Self-Contained Breathing Apparatus					X
Duct Tape All Joints		X	X		X
As Needed					
Leather or Cotton Work Gloves	X	X	X	X	X
Hearing Protection	X	X	X	X	X

Notes

* Combination organic vapor/HEPA cartridges

8.0 AIR MONITORING/SAMPLING REQUIREMENTS

8.1 Perimeter

Perimeter air monitoring/sampling will be conducted in accordance with the project air monitoring plan.

8.2 Industrial Hygiene Sampling

Eight-hour TWA samples which are representative of the level of exposure of personnel involved in all onsite work activities where personnel may be exposed to hazardous levels of airborne volatile organic chemicals will be collected and analyzed. Samples will be collected from the breathing air space of the employee within a 1-foot radius of the head. Personal monitoring pumps shall be attached to workers who have the highest expected exposure. Two "maximum risk employees" shall be selected for each operation to determine the maximum exposure limits. Maximum risk employees are defined as those onsite workers who are performing tasks closest to the expected or suspected source(s) of potential contamination. Additional personnel sampling of other employees shall be performed if the "maximum risk employee(s)" of an operation are found to be working at or above established "action levels."

Personnel sampling shall be done in accordance to NIOSH Method 1003 and analysis conducted by EPA Method 8020. Analysis will be performed by an AIHA accredited laboratory. The analysis to be performed will report results for all organic contaminants of interest. Results shall be available within 24 hours of sampling, or the next scheduled work day.

Personnel integrative sampling initially shall be done on a daily basis for the first week during opening and emptying drums. Following this initial period, sampling shall be conducted not less than once per work week during intrusive activities when potential exposure is expected to be the greatest. However, if the data generated during the initial sampling indicates that exposures are not significant, the SSO may terminate the integrative sampling and document exposures through the use of real-time instruments.

8.3 Real-Time Ambient Air Monitoring

Organic vapors and lower explosive limit/oxygen percentage will be monitored throughout the project. The primary purpose of this monitoring is to provide immediate feedback to the SSO regarding pollutant releases during intrusive activities, so that actions can be taken if necessary to reduce vapor releases in the work area. Monitoring data will be collected for these parameters throughout all intrusive site activities.

Real-time monitoring will include the following equipment. VOCs will be monitored using a Thermo Environmental Instruments, Inc. Model 580S PID with an 11.7 eV lamp or its performance equivalent. Lower explosive limits (LEL) and oxygen concentrations will be monitored using an MSA Model 261 LEL/O_2 meter or its performance equivalent. The LEL/O_2 meter is used to detect oxygen-deficient, oxygen-enriched, and combustible atmosphere.

All monitoring instruments will be calibrated daily in accordance with the manufacturer's recommendations.

All real-time air monitoring will be conducted according to the project air monitoring/sampling plan.

Colorimetric detector tubes will be kept onsite by the Contractor. Tubes will correspond with the chemicals of concern for the Site. They will be utilized upon an indication of a PID reading of 1 ppm, for the purpose of qualitatively determining which chemical potential exposure exists and to determine what type of respiratory protection is appropriate.

A daily log will be kept at the Site to record all monitoring data. The data will be summarized as part of a daily report, including parameter, instrument type, air concentration measured, time, and location.

Table 8-1 provides the action levels to be utilized for this project.

TABLE 8-1

MONITORING INSTRUMENT ACTION LEVELS UNLESS OTHERWISE DIRECTED

	Air Quality Measurement	Response
I. Exclusion Zone Action Level - Volatiles		
PID	0 - 5 ppm above background in breathing zone	Level D
PID	5 - 10 ppm above background in breathing zone	Level C
PID	Above 10 ppm above background in breathing zone	Level B
Perimeter Action Level		
PID	1 ppm above background in the breathing zone - sustained for 5 minutes	Institute vapor suppression controls (i.e., close trench, apply foam, cover excavation with plastic)
Action Level - Combustible Atmosphere		
CGI	Less than 10 percent LEL unknowns	Normal monitoring
CGI	Greater than 10 percent LEL unknowns	Continuous monitoring Check offsite impact
CGI	Greater than 20 percent LEL unknowns	Stop work
Action Level - Colorimetric Detector Tubes		
Specific Contaminant	1/2 Applicable Exposure Limit	Level C
Specific Contaminant	Greater than 10 times Applicable Exposure Limit	Stop work; consult with HSO

9.0 DECONTAMINATION PROCEDURES

Decontamination of equipment and personnel will be performed to extend the useful life of safety equipment, to prevent cross contamination of samples, and to prevent worker exposure to hazardous substances. All decontamination activities will be carried out within the contamination reduction zone, and any residuals generated (i.e., decontamination water, disposable gloves, disposable suits, etc.) will be placed in secure containers for disposal in accordance with local, state, and Federal regulations.

9.1 Equipment Decontamination

9.1.1 Decontamination Pad

A decontamination pad will be constructed as a washdown area for all materials, equipment, and vehicles used in the exclusion or contamination reduction zones.

The equipment/vehicles will be placed (driven) onto the decontamination pad and the proper wash/rinse procedures shall be followed. All waters will drain to a collection basin.

The sides of the decontamination pad will be enclosed with plastic sheeting, if necessary, to control the spray from the pressure washer and hoses.

The equipment/vehicles will be held for a short period of time to allow for the drippings to be retained in the collection basin. Equipment will then be permitted to be removed from the CRZ to a clean area.

All equipment/material decontamination activities will require the use of poly-coated Tyvek or its performance equivalent for the purpose of splash protection. Also facial splash shields must be utilized during decontamination procedures.

9.1.2 Small Equipment Decontamination

- Small equipment such as that associated with sampling or excavation (shovels, picks, chisels, hammers, etc). will be transported from the exclusion or contamination reduction zones to the decontamination pad after use.

- Equipment will be washed with a hot water high pressure spray ("steam-type" cleaner).

- If the equipment does not appear to come clean, it will then be scrubbed down with soapy water using brushes and a phosphate-free soap. Equipment will then be rinsed, by hose, with water.

- Equipment will then be allowed to air dry.

9.1.3 Large Equipment Decontamination

- Large equipment such as backhoes, loaders, graders, dozers, and drill rigs shall be driven or carted from the exclusion or contamination reduction zones to the decontamination pad.

- Equipment will first be washed with a hot water high pressure spray.

- If the equipment does not appear to come clean, it will then be scrubbed down with soapy water using brushes and a phosphate-free soap. Equipment will then be rinsed, by hose, with water.

- Equipment will then be allowed to air dry.

9.2 Personnel Decontamination

9.2.1 Personnel

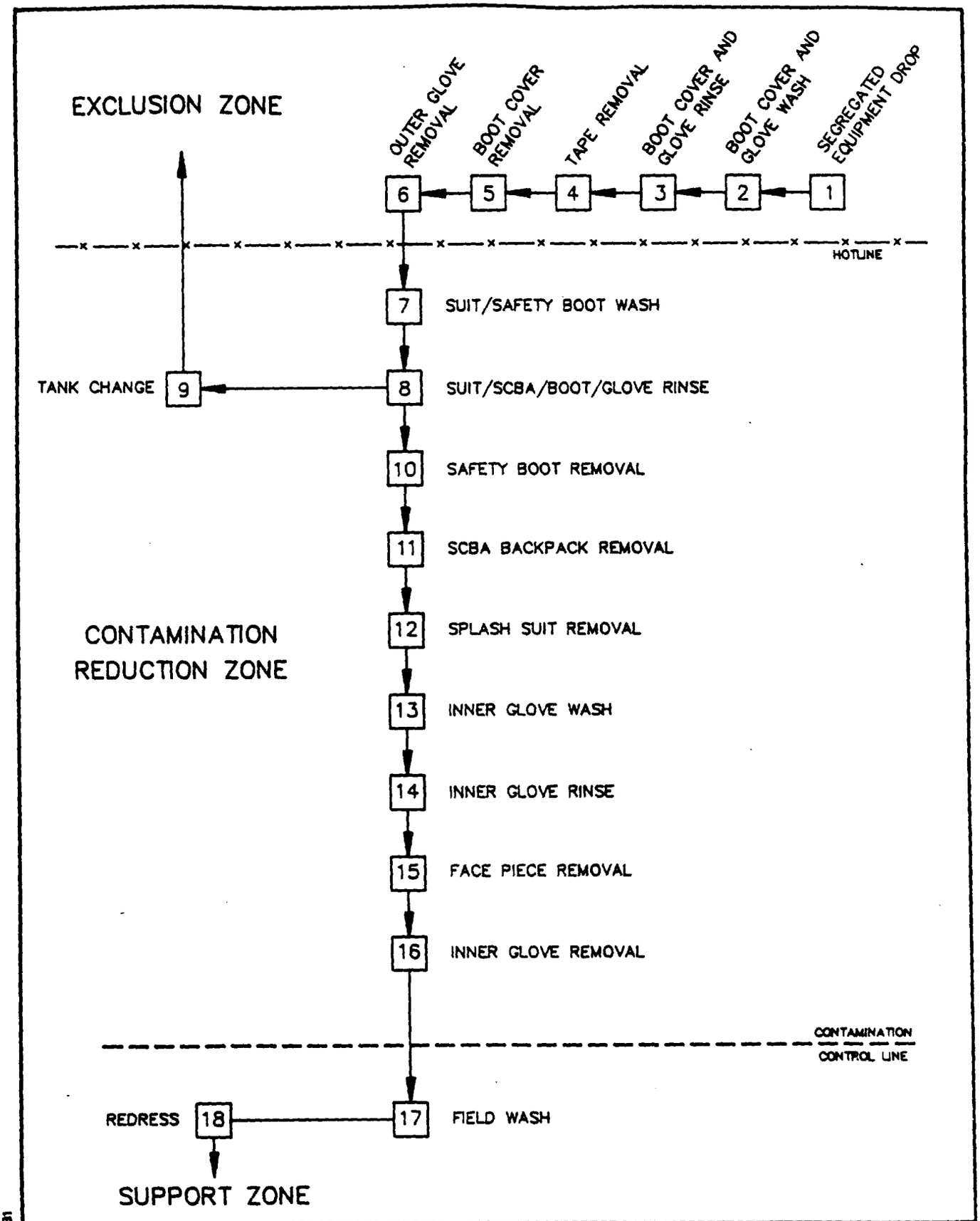
Prior to any breaks, after exit from the EZ, personnel must wash hands and face, especially if any hand-to-mouth activities are expected, i.e., smoking, drinking, or eating.

All personnel who have entered the EZ or CRZ will be required to shower at the end of the day before leaving the Site. However, this requirement does not apply to those individuals entering the EZ or CRZ inside of a vehicle for brief periods (i.e., truck drivers), upon approval of the SSO.

9.2.2 Equipment

Personnel decontamination will consist of soap and water washings to remove contaminants from reusable protective gear (i.e., neoprene boots, chemical-resistant gloves, and full-faced respirators). Disposable protective apparel will be removed in a manner that will prevent the spread of contaminants to other clothing (i.e., remove gloves by turning them inside out).

The detailed procedure for personnel decontamination will depend on the level of respiratory and dermal protection required for the specific work task. The general sequence of decontamination and removal of protective apparel is illustrated in Figures 9-1, 9-2, and 9-3. The extent of washing required or modifications to the sequence will be specified by the SSO.



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DECONTAMINATION PROCEDURES
LEVEL B PROTECTION

SCALE: NONE | FIGURE NUMBER: 9-1

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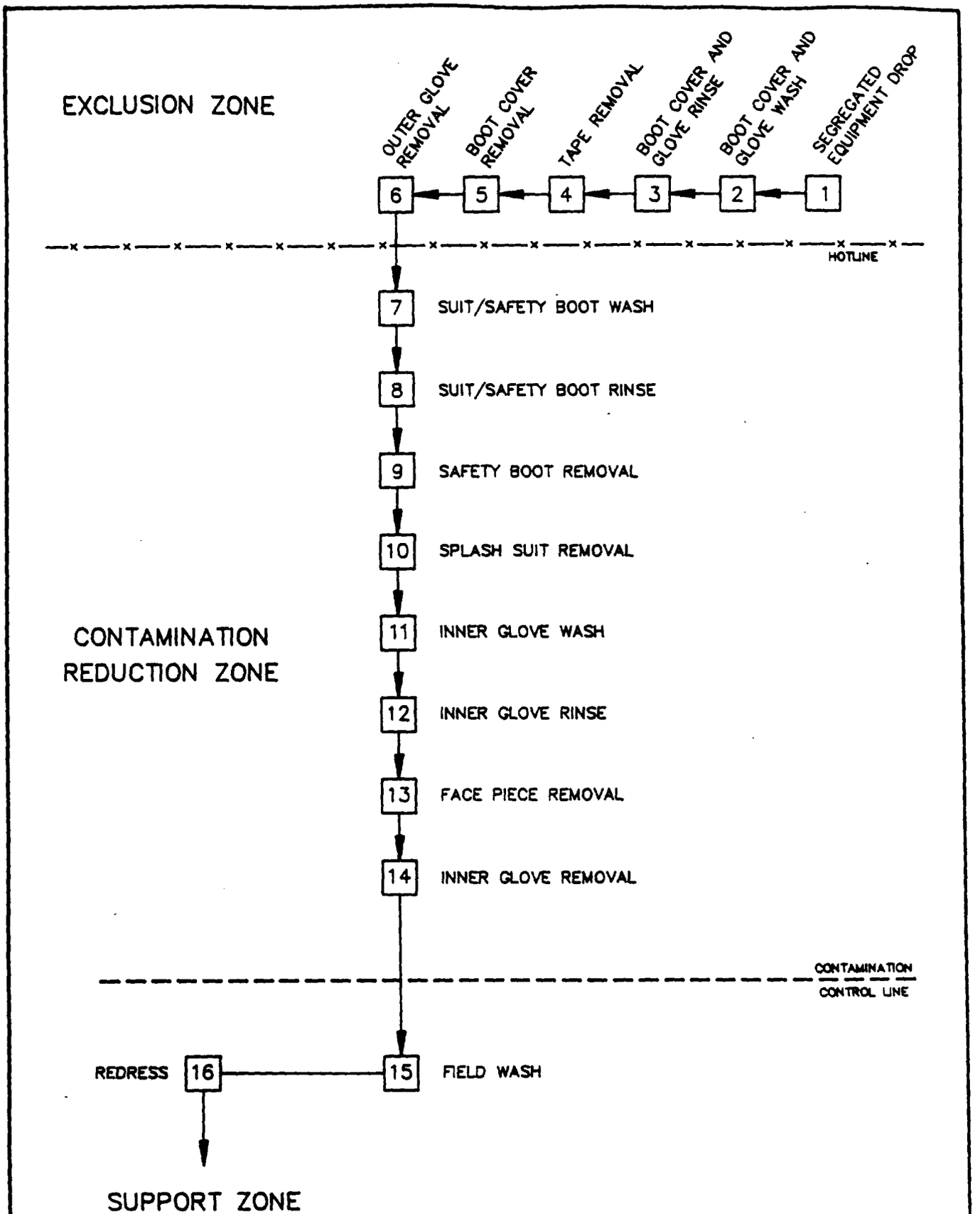

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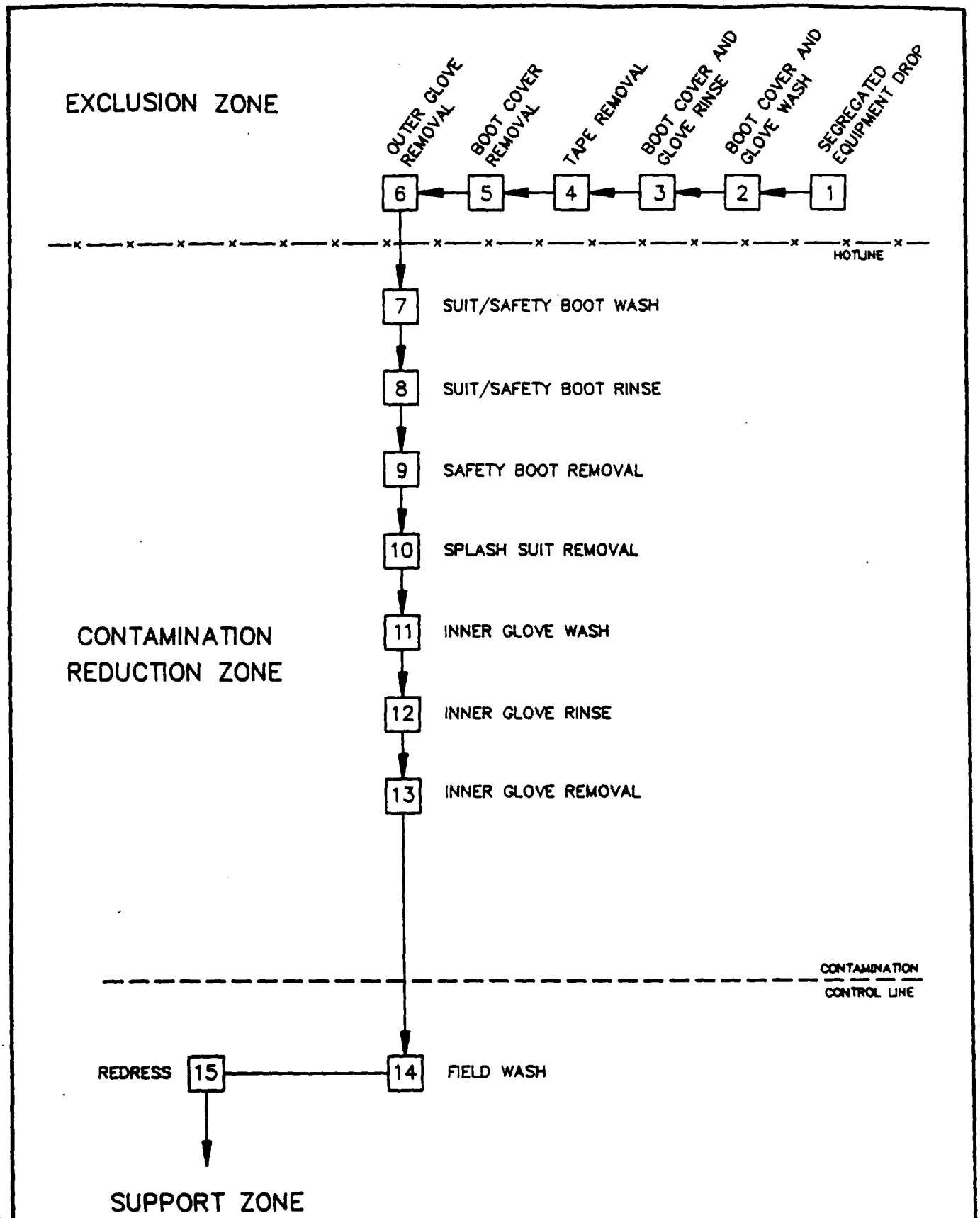
DECONTAMINATION PROCEDURES
LEVEL C PROTECTION

SCALE: NONE | FIGURE NUMBER: 9-2 | REV 0



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DECONTAMINATION PROCEDURES
MODIFIED LEVEL D PROTECTION

SCALE: NONE | FIGURE NUMBER: 9-3 | REV: 0

FILE: V:\FORMS\LEVEL-01

9.3 Community Public Health Preservation

The health concerns for the community are of utmost concern. Precautions undertaken to prevent any contamination from leaving the Site shall include:

- All equipment (mobile and portable) will be decontaminated before leaving contaminated areas.
- Suspended solids in surface runoff will be prevented from migrating offsite.
- Dust suppression techniques will be used as necessary to keep dust levels at a minimum.

10.0 STANDARD OPERATING PROCEDURES

10.1 General

Various control methods are discussed throughout this HSP, as appropriate to the specific topic or section in question. Institution of these control methods, be they engineering, administrative, or PPE, will lessen or mitigate personnel exposure potential to chemical/physical hazards. Several of these controls were already discussed in this hazard assessment section. Others may include:

- Use of remote control devices to open drums that visually indicate potential for rupture. The applicable TL must determine applicability of remote drum opening. If any question arises, he/she shall consult the SM and SSO for input/guidance.
- Use of PPE, respiratory protection, and employment of decontamination.
- Implementation of the SOPs included in the SOP section of this HASP.

The following Standard Operating Procedures (SOPs), engineering controls, and/or work practices are to be enforced during work onsite:

- All personnel are responsible for complying with all applicable regulations (i.e., OSHA) for employing safe operating procedures while performing their duties. A copy of all applicable OSHA regulations will be kept onsite.

- All personnel must comply with Health and Safety SOPs and pertinent requirements regarding health and safety as depicted in site-specific training. As indicated, these requirements will be kept on the health and safety file onsite.

- All personnel must attend site-specific training prior to working/visiting in the EZ or CRZ.

- All personnel must conduct their activities in a manner pursuant to the contents of this HSP. Violations of HSP requirements will be brought to the attention of the TL by the SSO. If satisfactory results are not obtained, the SM and PM will be advised. Any violation of this HSP may be considered grounds for dismissal.

- All personnel must satisfy medical surveillance requirements prior to working in an area where the potential for exposure exists.

- Any person using prescription or non-prescription drums must first notify the SSO so that it can be determined that these drugs do not potentiate the effects of site contaminants.

- No one may use cosmetics while onsite as these can potentiate the effects of some chemical substances.

- Eating, drinking, smoking, chewing gum or tobacco, or any other hand-to-mouth activities are prohibited in the EZ and/or CRZ due to the potential for contaminant ingestion.

- Upon leaving any designated EZ, personnel must thoroughly wash their hands and face as soon as possible, following personnel decontamination.

- Any unnecessary contact with potentially-contaminated substances must be avoided. This includes contact with potentially-contaminated surfaces and/or equipment. Monitoring instruments and other hand-held items are not to be placed on ground surfaces or other potentially-contaminated surfaces.

- No facial hair, which can interfere with achieving a satisfactory face-to-facepiece seal with respiratory protection equipment, is permitted on any person required to use such equipment.

- Monitoring instrument action levels shall be observed.

- If personnel note any warning properties of chemicals or even remotely suspect the occurrence of exposure, they must immediately notify the SSO for further direction.

- Work cessation due to electrical storms, high ambient heat loads, or other such adverse weather conditions shall be determined by SM and SSO.

- No open fires will be permitted.

- Site personnel are not to undertake any activity which would be considered a confined-space entry without first being trained in the proper procedures by the SSO and completing a confined space entry permit.

- Any areas targeted for subsurface investigation must first be investigated to determine the presence of underground utilities. This information is to be documented in the appropriate TL's logbook.

- No equipment shall be operated within a 20-foot radius of energized power lines.

- No one, under any circumstances, shall enter an excavation without a confined space/limited egress permit and adequate sloping and/or shoring.

- All excavation activities will require that fill be located by the area in question. There is a remote possibility that an unexpected release could occur, compromising personnel protection. In the event this occurs, personnel can smother the affected area with soil via use of the backhoe bucket and then immediately evacuate the area.

- Site rules (buddy system, safety checks before leaving field office, before entering EZ, etc.) shall be enforced.

- Eating and smoking shall be prohibited in the EZ and CRZ, except as identified by the SSO.

- Wearing contaminated protective apparel in the support zone and restrooms shall be prohibited.

- Before initiating any non-routine operation in any restricted area, all personnel shall consult the SSO about health and safety requirements for the operations.

- A buddy system shall be implemented for all work in the EZ, including the activities during the pre-operational start-up period.

- The Contractor shall provide an emergency shower facility for wholebody washdowns and eye wash in the event of an emergency in conformance with ANSI Standard Z358.1-1981. The eye wash shall supply a minimum of 0.4 gallons per minute (gpm) of water for 15 minutes.

- Physician-approved first-aid kits shall be kept onsite during onsite work. At a minimum, one kit shall be placed in the health and safety office.

- First-aid equipment shall be approved by physician and be able to provide stabilization for patients requiring offsite treatment and general first aid.

- The Contractor shall provide and maintain, at a minimum, one 20-pound Type ABC fire extinguisher at each work site. Additionally, all heavy equipment and all dedicated site vehicles shall be equipped with a 10-pound Type ABC fire extinguisher.

- All work areas shall be adequately illuminated by either natural or supplementary electrical lighting. The minimum illumination level in any active work are (i.e., active exclusion zone) shall be 10-foot candles. All other areas of the Site shall be illuminated according to the requirements of 29 CFR 1910.120(m).

- All electrical installations shall conform to the National Electric Code, 29 CFR 1926 (Subpart K).

- All loading and unloading of materials onsite shall conform to the requirements of the U.S. Department of Transportation (DOT). These requirements shall including grounding and bonding during flammable liquid transfers; proper placarding of any vehicle transporting hazardous materials from the Site; ensuring all drivers meet DOT driver qualifications; and ensuring that all vehicles being loaded or unloaded are secured from inadvertent movement according to DOT and OSHA requirements.

10.2 Handling Drums and Containers

After an initial survey, drums will be classified into three categories:

- Deteriorated and unsafe to move (DUM)
- Deteriorated but safe to rearrange (DSR)
- Not deteriorated and safe for transportation (NDST)

DUM drums shall be either overpacked or their contents transferred to a drum meeting DOT, OSHA, and U.S. EPA requirements. If, during this stage, any drums are warped, bulging, or otherwise visually damaged, the drum will be opened remotely for transferring or sampling purposes.

DSR drums shall be sampled and rearranged, according to compatibility test results, prior to preparing for transportation. Transportation preparation shall include either overpacking or transferring the contents into a drum/container meeting DOT, OSHA, and U.S. EPA requirements.

Following compatibility testing, all drums shall be grouped together within staging area(s). Additionally, drums of differing compatibility types will be segregated within each designated staging area.

During sampling, handling, and transportation of all drums, the following requirements shall be addressed to ensure personnel safety and health:

- Drums or containers that cannot be inspected before being moved because of storage conditions (i.e., stacked behind other drums, stacked several tiers high in a pile, etc.) shall be moved to an accessible location and inspected prior to further handling.

- Unlabeled drums and containers shall be considered to contain hazardous substances and handled accordingly until the contents are positively identified and labeled.

- Site operations shall be organized to minimize the amount of drum or container movement.

- Prior to movement of drums or containers, all employees exposed to the transfer operation shall be warned of the potential hazards associated with the contents of the drums or containers.

- U.S. Department of Transportation specified salvage drums or containers and suitable quantities of proper absorbent shall be kept available and used in areas where spills, leaks, or ruptures may occur.

- Where major spills may occur, the Spill and Discharge Control Plan shall be implemented to contain and isolate the entire volume of the hazardous substance being transferred.

- Fire extinguishing equipment meeting the requirements of 29 CFR Part 1910, Subpart L, shall be on hand and ready for use to control incipient fires.

- Where an airline respirator system is used, connections to the source of air supply shall be protected from contamination and the entire system shall be protected from physical damage.

- Employees not actually involved in opening drums or containers shall be kept 20 feet away from the drums or containers being opened.

- If employees must work near or adjacent to drums or containers being opened, a suitable shield (i.e., sand bags, lexan plastic, or other material capable of deflecting potential debris and liquid resulting from an explosion) that does not interfere with the work operation shall be placed between the employee and the drums or containers being opened to protect the employee in case of accidental explosion.

- Controls for drums or container opening equipments, monitoring equipment, and fire suppression equipment shall be located behind the explosion-resistant barrier.

- When there is a reasonable possibility of flammable atmospheres being present, material handling equipment and hand tools shall be either intrinsically safe or U.L. listed for Class I, Division 1 locations.

- Drums and containers shall be opened in such a manner that excess interior pressure will be safely relieved. If pressure can not be relieved from a remote location, appropriate shielding shall be placed between the employee and the drums or containers to reduce the risk of employee injury.

- Employees shall not stand upon or work from drums or containers.

- Material handling equipment used to transfer material from drums and containers shall be selected, positioned, and operated to minimize sources of ignition related to the equipment from igniting vapors released from ruptured drums or containers. This will include ensuring that all equipment is bonded and grounded.

- Drums and containers containing packaged laboratory wastes shall be considered to contain shock-sensitive or explosive materials until they have been characterized.

- If crystalline material is noted on any container, the contents shall be handled as a shock-sensitive waste. Procedures to be instituted include the following:

  - Any drums suspected of containing shock-sensitive waste will be isolated. Surrounding equipment will be removed from the immediate area if such equipment can be removed safely and expeditiously.

  - A barricade of red flagging and DANGER tape will be placed around the potentially shock-sensitive drums. A minimum 50-foot radius is required; however, this radius can be increased if deemed necessary by the SM and/or SSO.

  - Personnel will not be permitted to work or stand within the restricted area.

  - An explosive ordnance or relative hazardous material expert will investigate the drums in question. He/she will be tasked with developing procedures for handling/sampling the drums. Such procedures must be reviewed/approved by PM, SM, and HSO.

  - Additional training will be conducted prior to personnel handling/sampling drums containing shock-sensitive waste. Such training will be appropriately documented.

- Drums or container staging areas shall be kept to the minimum number necessary to identify and classify materials safely and prepare them for transport.

- Staging areas shall be provided with adequate access and egress routes.

- Bulking of hazardous waste shall not be permitted.

- Tanks and vaults containing hazardous substances shall be handled in a manner similar to that for drums and containers, taking into consideration the size of the tank or vault.

10.3 Confined Space/Limited Egress

This procedure requires a confined space entry permit to be obtained prior to each entry and also requires that all personnel involved be familiar with all equipment, procedures, and safeguards utilized during the specific task.

General

Confined Space/Limited Egress. Any space or enclosure that has limited access/egress ports; is not intended for continuous occupancy by human beings; and may contain a hazardous atmosphere or other safety/health hazard. Typical CS/LE situations include, but are not limited to: tanks, diked areas, tunnels, silos, digestors, sewers, storage bins, barges, shafts, hoppers, holds of ships, process vessels, underground utility vaults, cisterns, degreasers, pits, vats, boilers, ducts, manholes, stacks, pipelines, tank cars, septic tanks, steam, condensers, trenches, bunkers, pumping a lift station, and equipment housings.

Responsibilities:

The responsibilities defined below are specific to this procedure and in addition to those general responsibilities defined in Section 2.0 of this HSP.

A. Project Manager

Shall ensure that a written CS/LE permit is developed and implemented, as required by this procedure, for any applicable project under his/her control.

B. Site Safety Officer

1. Shall assist the Project Manager, when necessary, in determining when CS/LE procedures are applicable.

2. Shall review CS/LE permits for compliance with this procedure prior to occurrence of field work.

C. Project Team

Shall provide input to the Project Manager and shall clearly define the scope of work to occur in the field so the appropriate determination regarding the need for CS/LE takes place.

D. Health and Safety Officer

1. Shall provide technical input to the Project Manager during the development of CS/LE permits when requested.

2. Shall monitor compliance with this procedure through final audit.

E. Site Manager

Shall ensure that CS/LE protocols outlined in written permits are followed in the field. Shall also ensure that if unexpected situations arise in the field requiring CS/LE (which was not expected) appropriate protocols are followed.

Procedures:

Entry Decision

CS/LE entries shall only occur when there is no alternative means of completing the operation. CS/LE entries are to be instituted as a last resort. Entry into a CS/LE enclosure shall be by permit only. The permit serves as authorization for an entry into a specific space for a specific task. The permit illustrates that existing conditions and, subsequently, potential hazards have been evaluated by the onsite SSO and identifies the protective measures specified to ensure worker safety. The completed entry permit will serve as a safety outline before entry and will be reviewed by the SSO with the entry team and standby personnel. The entry permit will identify:

1. The location of the CS/LE area and a description of the entry task.

2. Known and potential hazards that may be encountered in the CS/LE area.

3. Isolation checklist:

    1. Mechanical ventilation (volumes)
    2. Mechanical isolation and tagout (both)
    3. Electrical lockout and tagout (both)
    4. Blanking and/or disconnecting of all lines

Training

Personnel required to work inside, or in support of those working inside CS/LE areas shall have site-specific training in the following areas:

1. Associated CS/LE hazards
2. Procedures for emergency entry/egress
3. Respiratory protection
4. Safety equipment
5. Lockout/tagout procedures
6. Rescue procedures
7. Permit system
8. Work practices

Testing and Monitoring

CS/LE entry shall not occur without the use of appropriate supplied-air respirators and dermal protection until appropriate initial testing has been conducted to assure the atmosphere in the CS/LE area is safe. Monitoring shall be conducted for oxygen content, combustible gases/vapors, toxic contaminants, and any other tests specified by the SSO. Such monitoring shall be done on a continuous basis while personnel are in the CS/LE enclosure.

Entry into the CS/LE area shall not be permitted, without use of appropriate supplied-air respirators and dermal protection under the following conditions:

1. Oxygen concentrations less than 19.5 percent (148 mm Hg*) or greater than 23.5 percent (178 mm Hg*).

2. Toxicity measurements indicate an Immediate Danger to Life and Health (IDLH) atmosphere or unknown contaminated atmosphere exists in the CS/LE area.

No hot work will be permitted in the CS/LE area when readings indicate greater than 10 percent of the LEL.

* Based on Atmospheric Pressure of 760 mm HG (Sea Level).

Whenever any of the no entry permitted/evacuation conditions occur, the volumes of mechanical ventilation supplied to the space shall be increased and maintained. Entry or re-entry will be permitted when: (1) oxygen levels are measured greater than 19.5 percent and less than 23.5 percent; (2) LEL measurements fall below 10 percent; and (3) an IDLH atmospheric condition no longer exists.

Initial atmospheric samples shall be drawn while outside the CS/LE at least at the following locations:

1. Outside of entry point(s)
2. Immediately inside the entry point(s)
3. At least every 4 feet in depth of the CS/LE area to the surface of the floor or any remaining residues.

All initial monitoring results shall be recorded on the entry permit.

Protective Equipment and Clothing

The entry permit will specify the level of protection to be used for the CS/LE entry. As illustrated, if air contamination present is not identified and/or quantified, supplied-air respirators protection will be required.

Additional safety equipment in the form of safety belts, body harness, or wrist type harnesses with lifelines shall be provided and used for all CS/LE entries. Lifelines shall be attached to extraction devices outside the CS/LE area so that non-entry rescues may be accomplished.

At a minimum, standby personnel shall be equipped with at least the same level of protection as the entry team, as well as, supplied respirators suitable for IDLH atmospheres.

Other safety equipment that may be utilized where appropriate include safety nets, life jackets, electrical insulations, and barriers as the particular CS/LE area warrants.

Work Practices

As indicated, prior to entry, the SSO shall review the entry permit with all members of the entry team and standby team and shall be present during the operation. He will maintain communications and have ready access to emergency and support services and facilities.

Purging and Ventilation

All CS/LE enclosures shall be subject to purging and continuous ventilation after initial atmospheric testing but prior to any actual entry. The only exception to this requirement is where entry is made solely to obtain samples of materials remaining in the CS/LE area and initial atmospheric testing indicates:

1. No oxygen deficiency or enrichment.

2. LEL measurements are less than 10 percent.

3. Toxicity measurement is less than 10 percent of the established IDLH of the airborne contaminant present.

4. Organic vapor measurements coincide with the appropriate level of personal protective equipment employed for confined spaces.

5. Special conditions exist such that the above criteria do not apply and specific authorization is obtained from the CHSM.

Isolation/Lockout and Tagging

Except for areas where complete isolation is not physically possible (i.e., manholes, sewers, tunnels), all CS/LE areas shall be completely isolated from all other systems by such means as double block and bleed, blanking, or physical disconnection of all lines into the area. All lines that have been subject to the isolation actions shall be tagged to identify the reason for blocking, blanking, and/or disconnection. The tag shall contain the following statement:

THIS EQUIPMENT
REMOVED FROM SERVICE DUE
TO CONFINED SPACE WORK
AT _____

DO NOT OPERATE

The CS/LE area shall be electrically isolated to prevent accidental activation of moving parts or other electrical equipment serving the work area. Electrical isolation shall be accomplished by lockout of circuit breakers and/or power disconnects in the open (OFF) position by key-type padlock.

Mechanical isolation of moving parts shall be achieved by removal of chain or belt drives or by disconnecting linkages. Other moving mechanical parts shall be blocked in such a way as to preclude accidental rotation. Any mechanical isolation shall be tagged to identify the reason for the isolation.

Cleaning

Initial cleaning of any CS/LE area shall be done from the outside if at all feasible. If initial atmospheric testing shows a flammable atmosphere approaching the lower explosive limit (LEL) in the enclosure, it shall be inert gas purged, prior to starting ventilation.

The cleaning process itself may create an additional potential for hazard in the CS/LE. Examples of such conditions include:

1. Excessive heat stress in the enclosed space if it is steamed cleaned and not allowed to cool down.

2. Build up of toxic materials if a chemical neutralization is used and ventilation is not maintained or adequate.

Equipment, Instruments, and Tools

All tools and other equipment, including monitoring instruments, for use in CS/LE areas shall be inspected for compliance with the following requirements:

1. Tools and equipment will be appropriately maintained and kept clean.

2. All electrical equipment including portable tools, lighting, and power cords shall meet approvals in accordance with OSHA regulations found in 29 CFR 1910 Subpart S, including provisions for ground fault interruption protection and visual inspection of equipment for defects or damage.

3. Lighting used in CS/LE areas shall be of explosion proof design equipped with necessary guards and bearing Underwriters Laboratories (UL) or other appropriate approval listings.

4. Air activated tools shall be used where flammable liquids are present and shall be bonded to the CS/LE area.

5. Compressed gas cylinders, except those that are part of a SCBA or resuscitation equipment, shall never be permitted inside a CS/LE area. Cylinders used to supply compressed gases to CS shall be turned off at the cylinder valve when not in actual use, and the supply lines removed from the area.

6. Any ladders, scaffolding, and staging shall be adequately designed and secured and in conformance with OSHA regulations found in 29 CFR 1910 Subpart D.

7. Any equipment or instrumentation subject to use in the CS/LE area where flammable atmospheres may occur shall be listed as explosion proof or intrinsically safe by a recognized testing laboratory.

Recordkeeping

Copies of the entry permit will be maintained in an employee exposure record as required under 29 CFR 1910.20.

10.4 Hot Work

General

This procedure requires all tasks which involve hot work to be issued a hot work permit by the HSO or SSO. Check with local authorities regarding the need for hot work permit approval.

Responsibilities:

The responsibilities defined below are specific to this procedure and in addition to those general responsibilities defined in Section 2.0 of this HSP.

A. Project Manager

Shall ensure that a written hot work permit is developed and implemented, as required by this procedure, for any applicable project under his/her control.

B. Site Safety Officer

1. Shall assist the Project Manager, when necessary, in determining when hot work procedures are applicable.

2. Shall review hot work permits for compliance with this procedure prior to occurrence of field work.

C. Project Team

Shall provide input to the Project Manager and shall clearly define the scope of work to occur in the field so the appropriate determination regarding the need for hot work takes place.

D. Health and Safety Officer

1. Shall provide technical input to the Project Manager during the development of hot work permits when requested.
2. Shall monitor compliance with this procedure through final audit.

E. Site Manager

Shall ensure that hot work protocols outlined in written permits are followed in the field. Shall also ensure that if unexpected situations arise in the field requiring hot work (which was not expected) appropriate protocols are followed.

Requirements:

All projects involving hot work such as welding, cutting, etc. shall require completion of a hot work permit (attached) prior to commencement of such activities. Additionally, the following procedures shall be completed prior to commencing hot work:

- A safety briefing shall be conducted for those performing hot work; their signatures on the permit will indicate that this instruction took place and that pertinent rules/procedures are understood.

- A visual inspection of the work area shall be conducted. Any combustible material surrounding the work area shall be removed. Special attention shall be paid to areas where hot slag can fall or splatter. Any combustible material that cannot be readily removed shall be covered or otherwise shielded from the hot materials. Wetting a combustible surface or covering with 1 inch of soil or a fire blanket may suffice.

- A fire watch shall be designated. The fire watcher's sole responsibility shall be to monitor the welding or burning operation and have immediate access to a fire extinguisher of sufficient size and type for the potential combustible material. In addition, this person shall be trained in fire extinguisher use and shall be apprised of emergency information.

- All spaces, pipes, and pumps will be opened and tested for the presence of flammables and oxygen. If any flammable or combustible vapors exceed 10 percent LEL or oxygen levels exceed 23 percent, no work shall begin until levels are reduced. As a rule, no hot work shall begin when any combustible vapor is present.

- A hot work permit shall be completed and posted near all hot work areas. Personnel working in the vicinity shall know such procedures are taking place.

- Appropriate personal protective equipment as designated by the SSO on the permit, shall be worn by personnel performing hot work. Equipment that may be applicable:

  - Welding gloves made of leather or other fire-resistant material.
  - Apron or jacket made of leather or other fire-resistant material.
  - Eye protection and face protection with filter lenses as specified in CFR 1910.252 and EM 385-1-1.
  - If necessary, flash-fire protection.

It must be noted that this equipment will typically be used as a supplement (to be worn over) to chemically protective clothing, as most chemically protective clothing does not provide flame protection.

10.5 Underground Storage Tanks (UST)

Upon determination of a UST present in the work area, all activities shall cease in the immediate vicinity and the SM notified immediately. No work around the UST shall commence until an amendment to this HSP has been completed and approved.

10.6 Underground Utilities

If any underground utilities are unexpectedly located, cease all activity and notify the SM. The SM will be responsible for contacting the appropriate utility company if need be. Work will not continue until a proper location of the existing utility can be attained and/or any damage repaired and work can continue in a safe manner and without further damage.

10.7 Illumination

If practical, all major work tasks will occur during daylight hours. The illumination requirements set forth by OSHA in 29 CFR 1910.120(m) will be met.

10.8 Sanitation

10.8.1 Potable Water

- An adequate supply of potable water shall be provided onsite.
- Portable containers used to dispense drinking water shall be capable of being tightly closed and equipped with a tap. Water shall not be dipped from the container.
- Containers used to distribute drinking water shall be clearly marked and not used for any other purpose.
- Common cups are prohibited for distribution of drinking water; single service cups are required unless workers provide their own cups or a water fountain is available.
- When single service cups (to be used but once) are supplied, both a sanitary container for the unused cups and a receptacle for disposing of the used cups shall be provided.

10.8.2 Non-Potable Water

- Outlets for non-potable water shall be identified to clearly indicate that the water is unsafe and is not to be used for drinking, washing, or cooking purposes.
- There shall be no cross-contamination between potable and non-potable water systems.

10.8.3 Toilet Facilities

- The Site shall be provided with portable chemical toilets (i.e., Port-O-San toilets) with appropriate service.

- Toilet facilities shall be provided for employees as follows:

  - Twenty or fewer employees: one facility
  - More than 20, fewer than 200: one toilet seat and one urinal per 40 employees
  - More than 200: one toilet seat and one urinal per 50 employees

10.8.4 Food Handling

Food handling on the Site will be permitted only in the support zone and break area as delineated by the SM/SSO. All personnel who have entered the CRZ or EZ will be required to wash hands and face before handling food or eating.

10.8.5 Showers

Showers will be provided and maintained in a sanitary condition. Each employee who has worked in the CRZ or EZ will be required to shower prior to leaving the Site for the day.

11.0 ACCIDENT PREVENTION PLAN

This Accident Prevention Plan (APP) has been developed to serve as the accident prevention policy for all personnel, as well as site visitors and site government inspectors, involved with site preparation and material removal activities at the Site. Where appropriate, certain sections of the APP are completed by referencing pertinent sections of the HSP. Specific information is as follows.

11.1 Responsibilities

Although all personnel play a role in accident prevention, the effective implementation of this plan is dependent on line management. In keeping with previous roles and responsibilities discussed in the HSP, the Site Manager will be responsible for the implementation and enforcement of this APP. The Site Manager and applicable personnel will be held accountable for any violations to this HSP and/or its components.

11.2 Local Requirements

Besides the requirements listed in the HSP, there are no known local requirements.

11.3 Subcontractor Supervision

Subcontractors will be under the direct supervision of the Site Manager. The subcontractors will be required to follow all provisions of the HSP as part of their subcontract agreement.

11.4 Layout of Temporary Facilities

To be determined at startup of project.

11.5 Sanitation

Decontamination will occur as per the decontamination section of the HSP. Additionally, the number of portable toilets will be designated based on OSHA requirements, as will provisions for portable drinking facilities/dispensers.

11.6 Training and Indoctrination/Safety Meetings

The HSP documents all training to be conducted for this project. Included will be OSHA requirements (29 CFR 1910.120) and daily tailgate meetings. The Site Manager or his designee will conduct a daily tailgate meeting and document this meeting on a "Daily Safety Meeting" form.

11.7 Traffic Control and Hazard Markings

Control of moving equipment from contaminated to clean zones will occur via the decontamination procedures described in Section 9.0 of this HSP. Hazard markings relative to work zones will also be as per this section. Other hazards, warnings and/or markings, i.e., hot work, confined space, etc., will be designated as necessary by the Site Manager or respective TL in consultation with the SSO.

Traffic onsite will be restricted by a maximum speed limit of 10 miles per hour. Access/egress will be controlled by appropriate assigned personnel.

11.8 Job Cleanup, Safe Access, Egress

Proper housekeeping will be the responsibility of each supervisor and ultimately the responsibility of the Site Manager. The Site Manager or his designee will make a informal inspection on a daily basis (at day's end) of the main work areas, CRZ, shower facility, and support zone. The Site Manager will document this inspection on a "Safety Inspection Report Form."

Safe access and egress regarding traffic is discussed in the traffic control section of this APP. Regarding safe access/egress of personnel into exclusion zones, the supervisor will be responsible for accountability of their personnel's location, as discussed in the HSP. Supervisors will clear personnel for entry after inspecting for use of appropriate PPE and will clear personnel for the shower facility after appropriate decontamination in the work zone CRZ takes place.

11.9 Fire Protection and Emergencies

Fire protection and emergency information can be found in Section 12.0 of the HSP.

11.10 Jobsite Inspections

The Site Manager is responsible for daily jobsite inspections of the work area to ensure conformance to HSP requirements, OSHA, and other requirements or recommended practices. The SSO will audit work areas at his discretion and will bring any violations/discrepancies with the HSP or recommended practice to the Site Manager's attention. Ultimate resolutions of such violations will be documented in the health and safety logbook. In the event an imminent danger situation exists, as stated in the HSP, the SSO has stop work authority.

The SSO may perform unannounced audits at the jobsite. After the audit, the SSO will have a post-audit conference with the Site Manager to discuss findings and recommended corrective action. Those items that can be corrected immediately will be. The SSO will then prepare a written report to the Site Manager with recommended corrective action, and a time frame in which the Site Manager must respond to the audit. The SSO will track appropriate disposition/resolution of audit findings. If audit findings are not addressed on schedule, the Site Manager's superior will then be notified.

11.11 Accident Investigation

Any need to report an incident to outside personnel or agencies will occur as per the HSP. All accidents will be immediately reported to the Site Manager and followed by a written report within 2 working days. This form can be found in Appendix G of this HSP.

11.12 Fall Protection Systems

Any fall protection systems utilized for personnel must meet OSHA requirements. Manlifts will be used in most instances to perform work in elevated areas. The SSO shall ensure that such equipment meets OSHA requirements and comes equipped with safety belts/lanyards/lifelines. Any existing structure, i.e., stairs, platforms, etc. that will be necessary for personnel to climb/utilize to access work areas, will be inspected by the SSO to ensure load limit will not be surpassed, and appropriate handrails, midrails, toeboards, extensions are present as applicable. If portable ladders are purchased and used, the SSO shall ensure that OSHA requirements for such equipment are met.

11.13 Safe Clearance Procedures

Safe clearance procedures regarding electrical utilities can be found in Section 10.0 of this HSP.

11.14 Office Trailer Anchoring System

All site trailers will be anchored using screw-type ground anchors with metal straps.

11.15 Contingency Plans for Severe Weather Conditions

The following severe weather conditions will require shutdown of activities:

- Tornado
- Lightning (outdoor operations)
- Severe snow or rain storms (at discretion of Site Manager and SSO)

Any other work shutdown or modification of work activity due to inclement weather will be at the discretion of the Site Manager in consultation with the SSO.

11.16 Mechanical Equipment Inspection

Heavy mobile equipment will be inspected daily as used. Supervisors shall ensure that any equipment used by the work crew is "checked out" prior to use. The operator shall document usability in the equipment maintenance logbook.

11.17 Construction/Excavation Safety

All construction/excavation activity shall be monitored by the SM to ensure compliance with OSHA requirements. The SM shall consult the SSO for technical guidance regarding these regulations as necessary.

12.0 EMERGENCY RESPONSE PLAN

This section provides information regarding the action(s) to be taken by site personnel in the event of certain reasonably foreseeable emergencies. The information provided in this section should not be construed as all inclusive as each emergency situation may be unique and should not take precedence over professional judgements made during an incident. This section provides guidance so that logical judgements can be made.

12.1 Pre-Emergency Planning

Pre-emergency planning for this project will involve the following:

- Development and approval of this ERP and a corresponding Spill and Discharge Control Plan (SDCP).
- Coordination of the ERP with local health and emergency response agencies.
- Training of site personnel in appropriate emergency procedures.
- Modification of the ERP, whenever necessary, as conditions change.

12.2 Anticipated Types of Emergencies

Various emergency situations could possibly occur during remedial activities. These situations include:

- Fire/explosion
- Personal injury/illness
- Chemical spill
- Chemical releases to offsite receptors

The remaining sections of the plan provides information and procedures to be followed in the event any of these scenarios occur (individually or in tandem).

12.3 Lines of Authority, Personnel Roles, and Communication

The lines of authority and responsibilities for emergency action will coincide with the health and safety responsibilities discussed in the HSP. The Site Manager has overall authority for implementation of this ERP and all site emergency actions. This authority will be supplemented by input from the SSO who will act as second in command during emergency situations.

Specific roles and responsibilities to be carried out by site personnel will directly correlate to the nature of the incident. Site workers will be utilized to carry out the various response (or non-response) operations.

Communications during site emergencies will include the following:

- Site communications using alarms and radios
- Offsite communications with local health and emergency response agencies via telephones

Each team working at the Site, as well as the Site Manager and SSO, will carry portable two-way radios capable of communicating from a single site frequency. Additionally, as per the HSP, an air horn will be installed onsite to alert site personnel of emergency situations. The following signals will be used:

- Site Evacuation - One long blast for at least 10 seconds
- Emergency - Shorts blasts for at least 10 seconds

Once the situation has been evaluated, local emergency response agencies will be notified, as necessary, via the telephone. Telephones will be located at the site office. Specific protocol, as to who is to be notified in the event of a site emergency, is presented in the emergency alerting provisions of this ERP.

12.4 Training

During site-specific training, all site personnel will receive the level of training necessary for them to safely and effectively carry out their roles as specified in this plan. Personnel who are merely to evacuate to a safe location during incidents will be provided information regarding

safe distances and places of refuge. Other persons, who will actually respond to the incidents, will be trained in the specific response procedures and equipment to be used, such as use of fire extinguishers and control and containment (as described in the SDCP).

12.5 Emergency Recognition and Prevention

Many emergencies can be prevented by compliance with the HSP, the SDCP, and all relevant regulatory standards. However, it is recognized that such emergencies can arise. Visual observation, employee complaints, and/or air monitoring as per the AMP can aid individuals in identifying, recognizing, and initiating response to emergencies.

12.6 Safe Distances and Places of Refuge

Safe distances and places of refuge will correlate to the wind direction, topography, and the incident. Personnel will be advised to move to an upwind location at least 300 yards from any fires and/or chemical releases, and will be advised to continually monitor wind direction for changes (the crew leader will account for respective personnel). If moving upwind from these types of incidents is not possible without encountering the incident and subsequent exposure potential, personnel will be advised to move crosswind or downwind to a distance necessary to be out of the path of smoke, odors, or releases. During personal injury/illness incidents (unless they involve fires or chemical releases), distances from incidents will be such to prevent interference with emergency response.

12.7 Site Security and Control

Site security will consist of a person or several people designated by the Site Manager to control entry/exit of personnel and equipment to the Site during work hours. Security personnel will execute and enforce the Security Plan. Site security personnel will coordinate the arrival of any outside emergency services. Unauthorized persons will not be permitted to enter the Site during routine work operations or during emergencies.

12.8 Evacuation Routes and Procedures

All personnel will assemble at the site office, unless otherwise instructed, in the event that site evacuation becomes necessary. An alternate assembly point will be the parking lot (in support zone). The Site Manager will be responsible for roll call, i.e., personnel accountability.

12.9 Decontamination

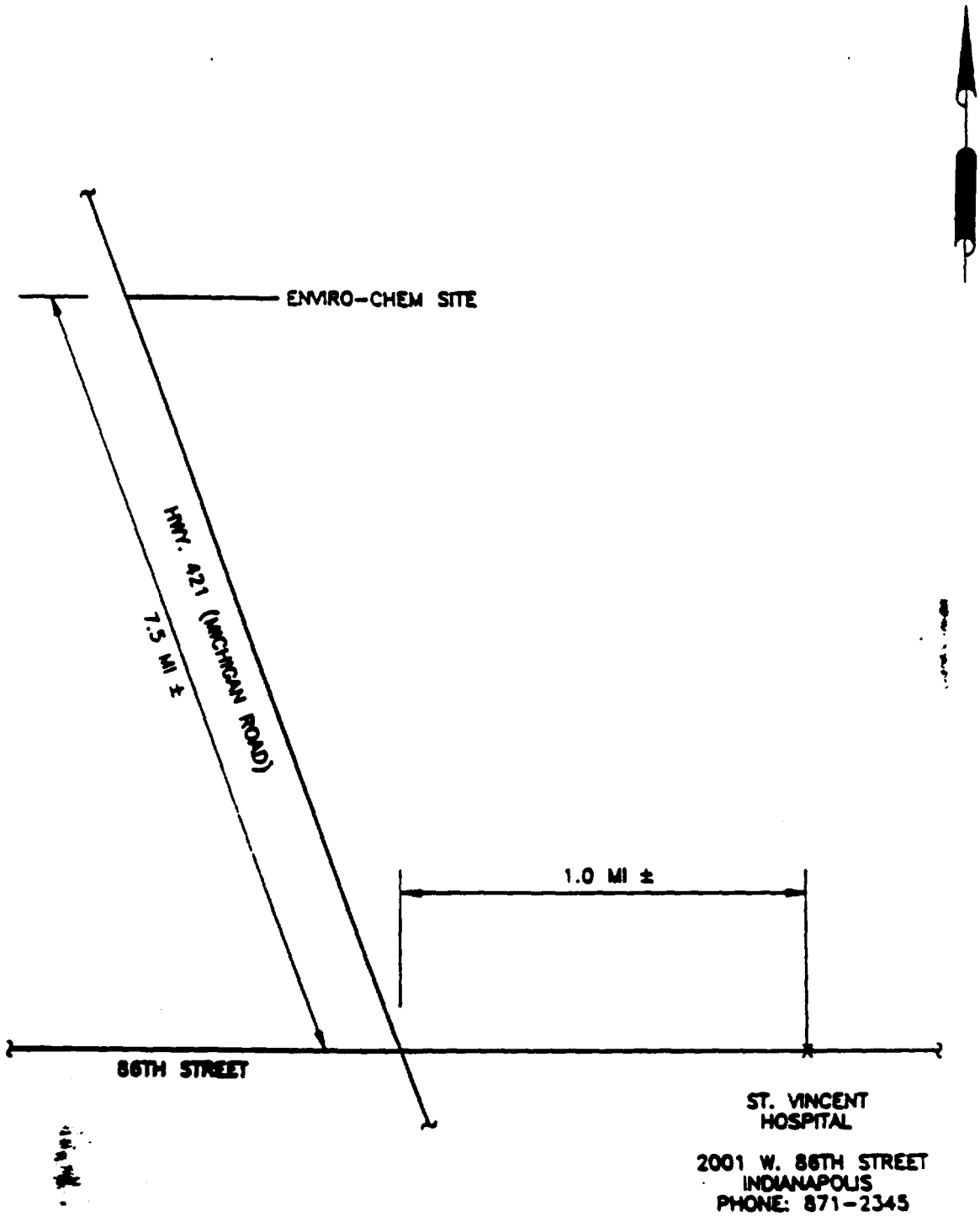
Decontamination during site emergencies will be the same as that for routine site operations, unless there is potential threat to human life or health. In such a situation, decontamination will consist of contaminated clothing removal and wrapping the injured party in a blanket. The vehicle used to transport the victim(s) to the medical facility will therefore be restricted in contacting contamination, and as such, should not be required to undergo decontamination.

12.10 Emergency Medical Treatment and First Aid

All emergency medical treatment, other than first aid, will be administered by the Paramedic Services dispatched through the emergency dispatch system. This treatment will continue during transportation to the hospital. All first aid will be administered onsite by the SSO who is certified in CPR and first aid by the American Red Cross. Physician-approved first-aid supplies will be maintained at various locations throughout the project site. All vehicles used to transport injured persons to the offsite medical facility will be provided with directions and a map to the facility. Additionally, the HSP will accompany the affected individual to the emergency care center. Figure 12-1 illustrates the route to the hospital from the Site.

12.10.1 Emergency Physician Access

In the event that any medical emergency arises due to work-related injuries/illnesses, a 24-hour emergency physician access plan will be established to enable any employee to communicate with the medical consultant.



AWD TECHNOLOGIES, INC	HOSPITAL ROUTE ENVIRO-CHEM SITE, ZIONSVILLE, IN	
	SCALE NOT TO SCALE	FIGURE NUMBER 12-1

12.11 Emergency Alerting Procedures

In the event of an emergency, the appropriate response agencies will be notified and appropriate project personnel will be notified as determined in advance. Table 12-1 provides the telephone numbers for the appropriate outside agencies.

12.12 Response Procedures (Priorities and Responses)

The following provides guidance toward prioritizing action and provides general response procedures to be followed. This information coupled with the SDCP should provide adequate information for the degree of response anticipated by employees. It is expected that personnel would only provide minimal or first line response to all emergencies.

12.12.1 First Priority

Prevent further injury/illness by:

- Protecting response personnel
- Isolating the scene to authorized personnel only
- Rescuing any injured parties
- Notifying Outside Emergency Assistance

12.12.2 Second Priority

- Provide first aid to those persons with life-threatening injuries or illnesses.

12.12.3 Third Priority

Alleviate the immediate hazards by:

- Extinguishing incipient stage fires
- Reducing chemical releases
- Containing any spill

TABLE 12-1

EMERGENCY REFERENCE NUMBERS

This site location (EMS address): 865 South, Route 421, Zionsville, Indiana

Emergency Information	Location	Telephone Number
Office	Indianapolis	(317) 469-0703
Ambulance	Zionsville	(317) 873-3363
Hospital Emergency Room	St. Vincent	
Hospital General Information	St. Vincent	(317) 871-2345
Police/Sheriff's Department	Zionsville	(317) 873-2233
Fire Department	Zionsville	(317) 873-3344
HAZMAT Team (Local)	Zionsville	(317) 241-4336
Site Manager		
Health and Safety		
Poison Information Center	National	1-800-762-0727
National Response Center for Environmental Emergency Only	National	1-800-424-8802
Boone County Health Department		(317) 482-3942
Project Manager	Office	
Corporate Health and Safety Manager	Home	
IDEM Emergency Response	Indianapolis	(317) 241-4336
U.S. EPA Project Manager		

12.12.4 Fourth Priority

- Provide first aid to all injured or ill parties and continue efforts to alleviate the hazard.

12.13 Small Fires

A small fire is defined as a fire that can be extinguished with the available 20-pound type ABC fire extinguisher. In the event of a small fire, the following minimum actions shall occur:

- Evacuate all unnecessary personnel from the area, if possible, to an upwind location or to an area not affected by airborne contaminants if an upwind location is not feasible.

- Attempt to extinguish fire using portable fire extinguisher or by smothering. .

- Request emergency response assistance (ambulance, fire, hospital, poison control center) as needed for any injuries or exposures to hazardous chemicals.

- Notify the Contractor.

12.14 Large Fires

In the event of a large fire or a small fire which cannot be extinguished, undertake the following minimum actions:

- Evacuate all unnecessary personnel from the Site, preferably to an upwind location.

- Order the appropriate level of protective clothing to be worn by personnel near the fire.

- Notify the fire department and other emergency response services (police, ambulance, hospital, poison control center) as needed.

- Notify the Contractor.

12.15 First-Aid Procedures

12.15.1 Physical Injury

- For minor injuries, routine first-aid procedures shall be used immediately. If required, the onsite emergency vehicle shall be used to transport patient to the hospital.

- For major injuries, an ambulance shall immediately be called and paramedics shall assess the nature and extent of the injury. In case of severe injury occurring along with chemical contamination of the victim, the victim shall be sprayed down with a water hose, or have the contaminated garments removed, or be wrapped in a blanket to present the spread of contamination, prior to being transported in the ambulance.

- In the event of bleeding, broken bones, shock, burns, heat exhaustion, heat stroke, seizure, insect stings, etc., the trained personnel shall use Red Cross approved measures for treatment.

12.15.2 Chemical Injury

- Appropriate safety gear shall be worn when treating the victim.

- The victim shall be removed to fresh air and resuscitated, if necessary.

- If clothing is chemically contaminated and injuries permit, clothing shall be removed and the skin flooded with copious amounts of water.

- If the eyes are contaminated, they shall be irrigated immediately with copious amounts of water for 15 minutes minimum.

- Call the nearest Poison Control Center for technical advice and assistance.

12.16 Emergency PPE and Equipment

The following inventory of PPE and equipment will be maintained onsite in sufficient quantities and locations to ensure an adequate supply for all emergency response personnel and to ensure that it is readily accessible:

- Industrial first-aid kit - one in the main CRZ and one in the site office
- Eye wash and deluge showers - located near each work area and the main CRZ
- Stretchers - located at the support zone
- Fire extinguishers - located at the entrance to each work area and in all trailers
- Pressure-demand self-contained breathing apparatus - two or more
- Four spare cylinders for SCBAs
- Tyvek/PE coveralls
- Boot covers
- Nitrile outer gloves
- Duct tape
- Face-shields
- Solvent- and oil-absorbent pads and brooms

12.17 Emergency Response Drills and Critiques

Emergency response drills will be conducted periodically throughout the course of work to be used as measures for evaluating the effectiveness of the ERP and response personnel. Each drill will be critiqued by one or more observer. The critique(s) will then be used to modify, as necessary, the ERP emergency equipment and/or response training.

13.0 SPILL RESPONSE, CONTROL, AND CLEANUP

This section provides contingency procedures to respond to spills of construction-related materials (solid or liquid) at the Site. These procedures are designed to remediate contamination that may result from a spill and to prevent further contamination of surface water, groundwater, soil, structures, equipment, or other materials.

13.1 Spill Control Equipment

Spill control equipment and cleanup materials will be onsite and readily available in the event of a spill. Storage locations for spill control equipment and cleanup materials will be determined in the field during mobilization. Storage locations will be clearly identified. These locations may be relocated as construction activities shift. Also, individual pieces of equipment may be moved from one location to another based on ongoing construction activities.

13.2 Training

Only persons trained in accordance with OSHA 29 CFR 1910.120e(7) will be equipped with the proper personal protective equipment and will perform cleanup procedures for spills. The SSO will determine the level of protection needed for a spill incident based on the circumstances. The air monitoring action levels presented in Section 8.3, Real-Time Air Monitoring, will be followed during any spill cleanup.

Persons involved in spill control and cleanup will be trained in the use of spill control equipment and cleanup materials.

13.3 Onsite Spill Response Procedures

In the event of a spill of potentially contaminated material, the procedures described below will be implemented.

Notification

The Contractor will immediately notify the U.S. EPA Project Manager and the ECC Project Manager of a significant spill if it threatens the offsite environment. If the spill is reportable and/or human health or the offsite environment are threatened, the Contractor will immediately contact the following agencies, as appropriate, in the order listed:

- Indiana Department of Environmental Management, Emergency Response
- Citizen Notification Contact as specified by the U.S. EPA Project Manager
- U.S. EPA Region V Response and Prevention (Spill Control)
- U.S. Coast Guard National Response Center

Spill Control/Containment

In the event of a spill, the first step will be to contain the spill to one area and prevent it from entering any natural or manmade waterways such as streams, manholes, and catch basins. To contain the spill, a dike will be placed around the source of the spill. The dike can be constructed of absorbent material or dirt. A common practice is to form a second dike around the first dike in case there is more material than the first dike can contain.

Once the area around the spill is contained, the source of the spill should be stopped by plugging, turning off the shutoff valve, and overpacking. This will only be attempted by trained persons to minimize risk to workers' personal safety.

Spill Cleanup

Once the spill is contained and controlled, the actual cleanup of the material can begin. Absorbent materials such as speedi-dry, absorbent pads, pillows, and booms may be used to absorb liquid material. Sand may also be used. Spark-resistant shovels will be utilized when picking up potentially contaminated materials.

Cleaned up materials can be either packed in drums or placed on a polyvinyl liner and covered with a polyvinyl cover.

Decontamination of Equipment/Structures/Materials

Any spill control or construction equipment, onsite structures, or other materials which come into contact with the spilled material will be decontaminated, as necessary. Complete cleanup may require showers and cleansing or disposal of clothing and equipment.

Disposal

All contaminated materials, including solvents, cloth, soil, and wood that cannot be decontaminated will be properly containerized, labeled, and disposed of as soon as possible and in accordance with applicable Federal, state, and local regulations. Disposal will be coordinated with provisions of the Materials Handling procedures presented in the Environmental Protection Plan.

Spill Incident Report

A spill incident report will be submitted to the U.S. EPA Project Manager and IDEM within 24 hours of the incident. This report includes information on the date the spill occurred, the type, quantity and location of spilled material, the cause of the spill, cleanup actions, and outside agencies involved.

In addition to the spill incident report, the Contractor will document all spills on site drawings and submit these drawings to the U.S. EPA Project Manager and IDEM when the project is completed.

13.4 Response to Offsite Spills

Despite all precautionary measures, the possibility exists that spills of decontamination water or wastes being transported offsite may occur. This section describes contingency procedures to respond to such incidents.

Decontamination Water

Because decontamination activities and treatment of decontamination water will be performed onsite, it is anticipated that any spills of decontamination water will be onsite. In the event that a spill of decontamination water occurs at the site perimeter and some liquid escapes beyond site boundaries, the emergency equipment and cleanup material onsite will be utilized to respond to both the onsite and offsite portions of the spill.

Transportation-Related Wastes

All contaminated waste material destined for offsite disposal will be transported by a hazardous waste transporter. Before awarding the subcontract, the Contractor will confirm that the transporter has a current, valid hazardous waste transporter identification number. The Contractor will also verify that the transporter has established contingency plans to respond to a transportation-related spill. The ECC Project Manager must approve the offsite transporter and disposal facility.

Cleanup of spills of waste material being transported offsite will be the responsibility of the transporter. If requested, the Contractor will provide additional information on the spilled material (if available) to enable a more expeditious cleanup.

If a discharge of material from a transporting vehicle occurs while in transit offsite, the following actions are expected to be taken to reduce potential migration of the waste material:

- The driver will immediately notify his office and the Contractor.
- Immediate measures will be taken to contain the discharge.
- The point of discharge will be secured and/or eliminated, if possible.
- The driver will remain with the vehicle, keep unnecessary people away, isolate the hazardous area, and deny entry to unauthorized personnel.
- All personnel will stay upwind, keep out of low areas, and not contact the spilled material as much as possible.

- Local authorities and the local hazardous materials response unit will be contacted.

- Other actions will be taken, as advised.

Notifying the proper authorities that a transportation-related spill has occurred is the responsibility of the transporter. After the transporter informs the Contractor of a spill, the Contractor will notify the U.S. EPA Project Manager, IDEM, and the ECC Project Manager. The Contractor will provide additional information as it becomes available.

14.0 ONSITE REFERENCE/DOCUMENTATION RECORDKEEPING AND REPORTING

The following section provides requirements and procedures that must be instituted for onsite health and safety references, documentation, recordkeeping, and reporting.

14.1 Required References

The following reference material is required to be present in the health and safety file in the site trailer:

- Corporate Health and Safety Manual
- Health and Safety SOPs
- Health and Safety Plan
- Current ACGIH TLV Booklet
- Current NIOSH/OSHA Pocket Guide
- Operational Manual for all health and safety equipment
- 29 CFR 1910
- 29 CFR 1926
- NIOSH/OSHA/USCG/U.S. EPA "Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities"
- American Red Cross First Aid and CPR Instructional Manuals

14.2 Required Documentation

The following documentation must be readily accessible from the onsite health and safety file:

- Written Hazard Communication Program which includes Hazardous Material Inventory and MSDSs. The Hazard Communication Program must be completed by the Contractor within 10 working days after notice to proceed is given. The written program will be made available to the ECC Trust's Engineer (Engineer) after such time.

- Applicable training records of all site workers for the following:

  - 40-hour introductory course
  - 8-hour supervisory course
  - 8-hour refresher course
  - Site-specific training

- Medical clearance for all site workers.

- Calibration/measurement logs for all site health and safety equipment.

- Health and safety logbook.

- Respiratory Protection Program which meets the requirements of 29 CFR 1910.134. The Respiratory Protection Program must be completed by the Contractor within 10 working days after notice to proceed is given. The written program will be made available to the Engineer after such time.

- Personal Protective Equipment Program which meets the requirements of 29 CFR 1910.120. The Personal Protective Equipment Program must be completed by the Contractor within 10 working days after notice to proceed is given. The written program will be made available to the Engineer after such time.

- Hearing Conservation Program which meets the requirements of 29 CFR 1910.95. The Hearing Conservation Program must be completed by the Contractor within 10 working days after notice to proceed is given. The written program will be made available to the Engineer after such time.

- Fit-test records for all employee on all types of respiratory protection available onsite.

14.3 Daily Information

The following information must be documented on a daily basis for each site worker:

- Operation(s) performed
- Time spent on each operation ($\pm$ 1/2 hour)
- PPE used for each operation (specific)

The following information must be documented on a daily basis for each operation:

- Monitoring equipment used
- Range (maximum and minimum) for each monitor
- Average reading for each monitor

The following information must be documented on a daily basis for the overall project:

- Environmental conditions (i.e., temperature, precipitation, cloud cover, wind speed, wind direction, etc.).

- Attendance of employees.

- Site visitors (include name, affiliation, areas/operation observed, PPE used, training/medical release, and site training received).

- Observations regarding health and safety of each operation.

- Health and safety problems encountered:

  - Personnel
  - Equipment

- Telephone/site meetings

  - Health and safety concerns discussed
  - Health and safety decisions and rationale

14.4 Training Logs

The training log(s) shall include both initial training, followup training, and visitor training. These logs shall include:

- Date
- Employee's name (attendance check) and record of attendance
- Materials covered
- Fit-testing performed and results
- Trainer(s)'s signature

14.5 Accident/Incident Reports

- Injuries, offsite releases, or accidents shall be reported to the CHSM immediately or as soon after control of the situation as possible.

The responsibility of this recordkeeping and reporting rests with the SM, although the SSO will complete the reports with assistance from onsite administrative personnel. Note that since both a health and safety logbook and logs/reports will be kept, the SSO has the option to incorporate completed logs/reports by reference into the health and safety logbook. All documents will be kept onsite in the health and safety file.

APPENDIX A

PROPERTY SUMMARY TABLES OF CHEMICAL CONTAMINANTS

TABLE V.1

CHEMICAL AND PHYSICAL PROPERTIES OF KNOWN/SUSPECTED SITE CONTAMINANTS

Contaminant (CAS No.)	OSHA PEL's NIOSH REL's ACGIH TLV's IDLH Value	Routes of Exposure	Warning Property Rating and Proper Air-Purifying Cartridge	Appearance and Odor	Relative Response Ratios and Recommended Probe/Span Settings	Description of Acute and Chronic Health Effects and Carcinogen Listing	Physical Properties
Tetrachloro-ethylene (127-18-4)	NIOSH Lowest feasible concentration OSHA 25 ppm - 8 hour ACGIH 50 ppm - 8 hour 200 ppm - STEL IDLH 500 ppm	Inhalation Ingestion Contact	Adequate Organic vapor cartridges Facepiece selected based on protection factor	Colorless liquid with a mild, chloroform-like odor	OVA response: 70% PID response: ~80% based on trichloroethylene response	Acute - Eye, nose, and throat irritation, dizziness, headache, skin reddening. Chronic - Liver injury. This compound is listed as a human suspected carcinogen.	MW: 165.8 BP: 250°F Sol: 0.02% Fl.P.: NA I.P.: 9.32 eV V.P.: 14 mm Source: NIOSH Pocket Guide

TABLE V.1

CHEMICAL AND PHYSICAL PROPERTIES OF KNOWN/SUSPECTED SITE CONTAMINANTS

Contaminant (CAS No.)	OSHA PEL's NIOSH REL's ACGIH TLV's IDLH Value	Routes of Exposure	Warning Property Rating and Proper Air-Purifying Cartridge	Appearance and Odor	Relative Response Ratios and Recommended Probe/Span Settings	Description of Acute and Chronic Health Effects and Carcinogen Listing	Physical Properties
Methylene Chloride (75-09-2)	OSHA 500 ppm - 8 hour 1,000 ppm - Ceiling 2,000 ppm - 5 minute maximum in any 2-hour period NIOSH Lowest feasible concentration ACGIH 50 ppm - 8 hour IDLH 5,000 ppm	Inhalation Ingestion Contact	Inadequate	Colorless liquid with a chloroform-like odor	OVA response: 90% PID response: 77% with 11.7 eV lamp	Acute - Fatigue, weakness, sleepiness, light headed, numbness in limbs, nausea, eye and skin irritation. Chroni - Dermatitis possible upon prolonged contact, may effect liver and kidney function upon prolonged exposure, may also effect central nervous system and cardiovascular system. This substance is listed as a suspected human carcinogen.	MW: 84.9 BP: 104°F Sol: 2% I.P.: 11.32 eV V.P.: 350 mm UEL: 22% LEL: 14% Source: NIOSH Pocket Guide

TABLE V.1

CHEMICAL AND PHYSICAL PROPERTIES OF KNOWN/SUSPECTED SITE CONTAMINANTS

Contaminant (CAS No.)	OSHA PEL's NIOSH REL's ACGIH TLV's IDLH Value	Routes of Exposure	Warning Property Rating and Proper Air-Purifying Cartridge	Appearance and Odor	Relative Response Ratios and Recommended Probe/Span Settings	Description of Acute and Chronic Health Effects and Carcinogen Listing	Physical Properties
Chloroform (67-66-3)	OSHA 2 ppm - TWA NIOSH 2 ppm - 60 min ACGIH 10 ppm - TWA IDLH 1,000 ppm	Inhalation Ingestion Contact	Inadequate	Colorless liquid with a pleasant odor	OVA response: 65% PID response: 49% with 11.7 eV lamp	Irritating to the skin and eyes. May cause headache, dizziness, nausea, fatigue, and disorientation. May product liver, kidney, and heart disorders. Carcinogenicity: This compound is classified as an occupational carcinogen by NIOSH and a suspected human carcinogen by ACGIH.	MW: 119.4 BP: 143°F Sol: 0.5% Fl.P.: NA I.P.: 11.42 eV V.P.: 160 mm LEL: NA UEL: NA Source: NIOSH Pocket Guide

TABLE V.1

CHEMICAL AND PHYSICAL PROPERTIES OF KNOWN/SUSPECTED SITE CONTAMINANTS

Contaminant (CAS No.)	OSHA PEL's NIOSH REL's ACGIH TLV's IDLH Value	Routes of Exposure	Warning Property Rating and Proper Air-Purifying Cartridge	Appearance and Odor	Relative Response Ratios and Recommended Probe/Span Settings	Description of Acute and Chronic Health Effects and Carcinogen Listing	Physical Properties
1,1,1-Tri-chloroethane (71-55-6)	OSHA and ACGIH 350 ppm - TWA 450 ppm - STEL NIOSH 350 ppm - Ceiling IDLH 1,000 ppm	Inhalation Ingestion Contact	Adequate Organic vapor cartridges	Colorless liquid with a mild, chloroform-like odor	FID response: 105% PID response: 74% with 11.7 eV lamp	Exposure may cause headache and dizziness. Eye irritation and dermatitis may occur upon direct contact. This compound may also cause cardiac arrythmia. Damage to liver and kidneys is also possible upon prolonged exposure. Carcinogenicity: Not listed.	MW: 133.4 BP: 165°F Sol: 0.4% Fl.P.: None I.P.: 11.00 eV V.P.: 100 mm LEL: 7.5% UEL: 12.5% Source: NIOSH Pocket Guide

TABLE V.1

CHEMICAL AND PHYSICAL PROPERTIES OF KNOWN/SUSPECTED SITE CONTAMINANTS

Contaminant (CAS No.)	OSHA PEL's NIOSH REL's ACGIH TLV's IDLH Value	Routes of Exposure	Warning Property Rating and Proper Air-Purifying Cartridge	Appearance and Odor	Relative Response Ratios and Recommended Probe/Span Settings	Description of Acute and Chronic Health Effects and Carcinogen Listing	Physical Properties
Trichloro-ethylene (79-01-6)	OSHA AND ACGIH 50 ppm - TWA 200 ppm - STEL NIOSH 25 ppm - TWA IDLH 1,000 ppm	Inhalation Ingestion Contact	Adequate Full-face required Organic vapor cartridges	Colorless liquid with a chloroform-like odor	OVA response: 70% PID response: 89%	Acute - Headache, visual disturbances, eye irritation, cardiac arrythmia, tremors, nausea, vomiting, dermatitis. Chronic - Liver and kidney damage, polyneuropathy, respiratory ailments. Carcinogenicity - This compound is listed as an occupational carcinogen by NIOSH.	MW: 131.4 BP: 189°F Sol: 0.1% Fl.P.: 90°F I.P.: 9.45 eV V.P.: 58 mm LEL: 8% UEL: 10.5% Source: NIOSH Pocket Guide

APPENDIX B

SITE-SPECIFIC PPE PROGRAM
(TO BE COMPLETED ONSITE BY HSS UPON COMPLETION OF MOBILIZATION)

SITE-SPECIFIC PPE PROGRAM

1.0 SITE HAZARDS AND PPE SELECTION

PPE selection is to be based upon exposure potential (i.e., chemical hazards, physical agents, mechanical/physical hazards, et. al) which, in turn, directly corresponds to the site involved and the task being performed.

The requirements set forth are based upon the substances present, potential for contact, and resistiveness of protective clothing, in accordance with available information.

Also take into account various hazard categories and PPE controls including, but not limited to:

Hazards to Consider

Moving, falling, or flying objects
Work above ground level
Pinch-points, nip points, rotating machinery
Noise sources
Contact with energized sources
Heavy objects to lift
Uneven, unstable, or slippery walking surfaces
Handling glass objects
Fire/explosion
Heat stress/cold stress
Biological factors (poison ivy/oak, insects, snakes, etc.)

PPE and Controls to Consider

Hard hats
Puncture resistant gloves
Steel toe/hard sole workboots
Leather work gloves
Safety glasses/goggles/face-shields
Work/rest regime
Electrolyte drinks
Hearing protection
Fall protection
Life-lines/retrieval-lines
Shin guards
Explosion shields
Life-vests
Lineman insulated gloves
Fire extinguishers (specify type)

SITE-SPECIFIC PPE PROGRAM
PAGE TWO

PPE REQUIREMENTS BY TASK (SAME AS TABLE IN HASP)		
Task	Hazard Potential	PPE Control Measures

2.0 PPE USE AND DONNING PROCEDURES

2.1 General Requirements

PPE is to be used as per the task in question. Donning procedures are to be in accordance with the design of the equipment. Special procedures include:

Example: Tape ankle and wrist seams

_____

_____

_____

_____

_____

_____

Donning procedures are to be demonstrated during site-specific training.

2.2 Additional Use Requirements

PPE shall be used in accordance with OSHA 29 CFR 1910 Subpart I.

All loose clothing shall be properly secured to prevent it from becoming caught in moving machinery.

All persons shall be deemed medically qualified to wear PPE prior to use. Medical Approval Forms will be maintained by HSS at the site office.

3.0 WORK MISSION DURATION AND LIMITATIONS DURING TEMPERATURE EXTREMES

Chemical degradation or permeation of Chemical Protective Clothing (CPC) and worker heat/cold stress can significantly affect the length of time a person can work in CPC. Based on the chemicals and concentrations anticipated to be encountered and the anticipated ambient air temperatures, the following restrictions shall apply to this project.

Activity	Restriction

4.0 MAINTENANCE AND STORAGE

PPE will be maintained and stored in accordance with the manufacturers' recommendations. PPE maintenance at this project will be performed by _____ or _____.

PPE at this project will be stored _____. The person responsible for storing and issuing PPE is the HSS. Reusable PPE which is potentially contaminated shall be stored at/in _____.

5.0 PPE DECONTAMINATION AND DOFFING PROCEDURES

PPE decontamination shall be performed in accordance with the corresponding HSP for this project. As per the HSP, the following decontamination requirements shall apply ("X" all that apply):

___ Contaminant Removal from Outer Surfaces of Reusable PPE
___ Contaminant Removal from Outer Surfaces of Disposable PPE
_X_ Doffing (removal) of PPE
___ Disposal of Contaminated PPE
___ Disposal of Decontaminated PPE
___ Personal Hygiene Procedures
___ Onsite Laundering of Potentially Contaminated Work Clothes
___ Offsite Laundering of Potentially Contaminated Work Clothes
___ Other _____

_____

_____

The following details the sequence of decontamination requirements which have been selected (X) for this project, including the two minimum requirements of doffing and personal hygiene:

_____

_____

_____

_____

_____

_____

_____

_____

_____

6.0 PPE TRAINING AND FITTING

All site personnel will be given site-specific PPE training as part of the site-specific health and safety training required by OSHA 29 CFR 1910.120. Documentation of the training shall be in accordance with the HSP. Personnel will receive training on each item of PPE they will be required to use. Minimum requirements shall include the need for PPE, proper use, proper donning/doffing (as previously discussed), and limitations. Any additional requirements are as follows:

_____

_____

_____

_____

PPE training shall be conducted by _____ prior to the worker using the item of PPE.

All site personnel shall be properly fitted for each item of PPE required by the "Use" section of this program.

PPE fitting (excluding respiratory protection) shall be obtained from prior records or shall be conducted by the person responsible for PPE storage and distribution, namely _____, who will maintain a record of sizes as described below:

PPE FIT RECORDS	
Worker	Item (Size)
Example: John Doe	Nitrile Gloves (11), Boot Covers (12), Tyvek (XLG)

7.0 PPE INSPECTION

PPE shall be inspected by the person issuing the PPE and by the worker in accordance with the manufacturers' recommendations.

Worker inspections shall be conducted before, during, and after each use.

The following inspection criteria shall apply for the PPE anticipated to be used.

Item	Inspection Criteria
Example: Nitrile Gloves	No holes or signs of chemical degradation

8.0 PPE IN-USE MONITORING

As discussed in Section 3.0, PPE in-use monitoring shall include observations of chemical degradation or permeation of CPC and signs or symptoms of heat/cold stress.

Site workers are encouraged to report any perceived problem or difficulties with PPE to _____, to include any signs or symptoms of heat stress such as rapid pulse, nausea, or chest paints; discomfort; fatigue; interference with vision or communication; restrictions of movement; unusual residues on PPE; or skin irritations.

Additional in-use monitoring shall be conducted by _____ as described below:

Degradation/Permeation Monitoring:

_____

_____

_____

Heat/Cold Stress Monitoring

_____

_____

_____

9.0 PROGRAM EVALUATION

This program shall be evaluated by _____ at a frequency of _____ in accordance with the following guidelines:

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

These evaluations shall be documented in the field health and safety logbook.

APPENDIX C

SITE-SPECIFIC RESPIRATORY PROTECTION PROGRAM
(TO BE COMPLETED ONSITE BY HSS UPON COMPLETION OF MOBILIZATION)

SITE-SPECIFIC RESPIRATORY PROTECTION PROGRAM

1.0 SELECTION OF RESPIRATORY PROTECTION

The implementation of this program will be under the direct supervision of _____. In order to simplify this procedure for field implementation, the following action levels have been determined for this project:

Activity/Location	Action Level/ Monitoring Equipment	Required Protection (Be Specific)

2.0 USE OF RESPIRATORY PROTECTION

Based on the site-specific chemical hazards and the anticipated site activities, the following respiratory protection is anticipated to be used at this project.

Activity	Respiratory Protection Anticipated

- Respiratory protection utilized to prevent exposures to toxic chemicals must only be used when accepted engineering controls are not feasible. Administrative controls (i.e., worker rotation) are not considered an accepted control measure to reduce personnel exposures on hazardous waste sites.

- Only approved respiratory protective equipment which has been properly selected for the job shall be used.

- In areas where an employee, because of a failure of a respirator, could be overcome by a toxic or oxygen-deficient atmosphere, at least one additional person shall be present. Communications (voice, visual, or signal line) shall be maintained between all individuals present. Planning shall be such that one individual will be unaffected by any likely incident and he/she will have the necessary rescue equipment to assist the others in case of emergency.

- All personnel onsite must be properly fit-tested for each type of equipment available onsite. The personnel qualified to perform this testing are _____. The records of all fit-tests for site personnel are maintained by _____ and can be reviewed at _____.

SITE-SPECIFIC RESPIRATORY PROTECTION PROGRAM
PAGE THREE

- All personnel onsite must be trained in the proper use of each type of respiratory protective equipment available. The following are qualified to conduct this training: _____. Records of this training are maintained by _____ and may be reviewed at _____.

- Respirators shall not be worn when conditions exist which present a poor face-to-facepiece seal. These conditions include, but are not limited to, the growth of a beard or sideburns, a skull cap with projects under the facepiece, or the use of regular corrective glasses because the temper bars prohibit a proper seal. Also, the absence of one or both dentures can seriously affect the fit of any respiratory protection.

- Workers shall only use the respiratory protective equipment which has been assigned to them. Assignment of respiratory equipment will be conducted by _____ in the following manner.

  _____

  _____

- Contact lenses shall not be worn while using respiratory protection unless prior approval is obtained from the CHSM.

- All individuals required to use respiratory protection must successfully pass a physical examination and receive written approval from the examining physician to use both positive and negative pressure respiratory protection. The written approvals for all site personnel are maintained by _____ and may be reviewed at _____.

- The actual use of all respiratory protective equipment shall conform to the manufacturer's operating instructions and training provided to the employee. A copy of all operating instruments for each type of equipment is maintained by _____ and may be reviewed at _____.

- Use of SCBA and APR will be documented by _____. Records will be kept current on a daily basis and can be reviewed at _____.

- Respirator Cleaning - All respirators must be cleaned and disinfected at a frequency necessary to insure that the proper protection is provided to the wearer. Those used by more than one worker must be cleaned and disinfected after each use.

  In order to accomplish this task, a respiratory cleaning station has been set up at _____. This station includes the following items to assist in the cleaning process:

  _____

  _____

  _____

  _____

The following instructions will be posted at the respirator cleaning station to ensure adequate cleaning and disinfection:

_____

_____

_____

_____

_____

_____

_____

_____

_____

SITE-SPECIFIC RESPIRATORY PROTECTION PROGRAM
PAGE FIVE

Based on project logistics, respiratory protection will be cleaned and disinfected by _____. The following schedule for cleaning and disinfection will be followed:

Equipment	Cleaning Schedule	Disinfection Schedule

3.0 RESPIRATOR INSPECTION

All respiratory protection equipment used on a routine basis must be inspected during cleaning. Worn or deteriorated parts must be immediately replaced or the unit tagged and taken out of service. Respirators for emergency use must be inspected at least every 30 days and after each use. Additionally, all respiratory protective equipment must be inspected by the HSSO weekly, regardless of use, and the condition documented on a suitable form signed by the HSSO.

The inspection procedure for each type of equipment will follow the manufacturer's recommended procedure. The specific procedures to be used are available onsite and can be reviewed by contacting _____.

The following schedule will be followed by the HSSO in implementing the inspection requirements:

Equipment	Inspection Date	Person Responsible

4.0 RESPIRATOR STORAGE

All respiratory protection utilized by employees must be stored in a convenient, clean, and sanitary location and according to specific manufacturer recommendations. Special attention must be paid to protecting respiratory protection from dusty conditions, temperatures extremes, and potential contamination during storage.

The following storage procedures will be utilized for equipment used on a routine basis (i.e., storage during non-use periods of a workshift or storage between workshifts):

_____

_____

_____

_____

All equipment not routinely used will be stored according to the procedures outlined below:

_____

_____

_____

_____

Any equipment not assigned to specific site personnel will be stored under the supervision of _____. This equipment will be stored at _____ following the procedures outlined below:

_____

_____

_____

_____

5.0 SURVEILLANCE OF WORK AREA

Appropriate monitoring of the work area conditions shall be performed frequently to establish the degree of employee exposure or stress. In order to simplify this surveillance, the following procedures have been determined for this project:

Monitoring Equipment Used	Frequency of Surveillance	Personnel/Area Monitored

Records of the above surveillance will be recorded on the following forms: (Attach blank field documentation format to be used). Completed forms will be maintained by _____ and can be reviewed at _____.

6.0 QUALITY ASSURANCE OF BREATHING AIR

Compressed air utilized for respiratory protection shall be of high purity. Breathing air shall meet at least the requirements of the specification for Grade D breathing air as established by the Compressed Gas Association. The following specifications must be certified by the vendor/supplier:

Oxygen Content - 19.5 percent to 23.5 percent

Contaminant	Maximum Allowed
Carbon Monoxide (CO)	10 ppm
Carbon Dioxide (CO_2)	1,000 ppm
Condensed Hydrocarbons	5 mg/m^3
Objectional Odors	None

Documentation assuring that breathing air meets the above specifications will be obtained by _____ by requesting such documentation from the vendor or supplier.

Site personnel can review this documentation in the _____.

7.0 PROGRAM EVALUATION

There will be regular inspections and evaluations to determine the continued effectiveness of this program. Documentation will be maintained by _____ and can be reviewed at _____.

The program will be evaluated in the following manner:

APPENDIX D

SITE-SPECIFIC HAZARD COMMUNICATION PROGRAM
(TO BE COMPLETED ONSITE BY HSS UPON COMPLETION OF MOBILIZATION)

HAZARD COMMUNICATION PROGRAM

Site Name: _____

Location: _____

1. Person responsible for the Hazard Communication Program:

   _____

2. Inventory of hazardous substances is attached and also located:

   _____

   _____

3. Material Safety Data Sheets (MSDSs) for all hazardous substances are located at:

   _____

   _____

4. Employees may review MSDSs and the standard by following this procedure:

   _____

   _____

   MSDSs not on hand, that are requested by employees, will be requested of suppliers within 7 days by letter.

5. The MSDS file is updated with new information and new hazards identified by:

   _____

   Any new hazards will be reported immediately to: _____ and affected employees notified within 30 days.

6. Containers of hazardous materials entering the site will be checked by:

   _____ to assure that they are properly labeled with the chemical name of the contents, the appropriate hazard warning, and the name and address of the supplier or manufacturer.

7. Onsite containers of hazardous materials will be labeled with the chemical name and hazard warning. Exceptions must be approved by:

_____

The following exceptions have been approved: _____

_____

_____

8. Non-routine tasks involving hazardous materials are:

_____

Procedures for complying with the Hazard Communication Standard for these jobs are the following:

_____

_____

_____

_____

9. Employee training is provided initially to all employees and for all new employees. This training covers the following areas:

   a. The basic requirements of the Hazard Communication Standard and their right to information on chemical hazards.

   b. Our company's program to comply with the standards and procedures to follow to see the standard, company program, and MSDSs.

   c. How to interpret and use the labels on containers of hazardous materials.

   d. The potential physical hazards and health effects of the hazardous substances and how to use MSDSs for more information.

e. How to handle the hazardous substances safely and other protective measures in place.

f. What to do in an emergency, release, or over-exposure to the chemicals.

g. How the presence of hazardous chemicals can be detected in the work area.

10. This training is documented in the following manner:

_____

_____

Records are maintained at the following location:

_____

11. Training concerning new hazards (new chemicals or new information on MSDSs) will be provided within 30 days and documented.

12. Periodic refresher training will be provided and documented as follows:

_____

_____

_____

13. Outside employees (subcontractors and visitors) will be advised of chemical hazards at our site in the following manner:

_____

_____

Contractors will be required to provide information on any chemicals used at this site as a condition of their contract.

Our company relies on the information contained in MSDSs as permitted by the OSHA Hazard Communication Standard and does not perform independent hazard determinations.

Reviewed and approved:

_____ _____

HSS Date

_____ _____

Project Manager Date

APPENDIX E

SITE-SPECIFIC HEARING CONSERVATIVE PROGRAM
(TO BE COMPLETED ONSITE BY HSS UPON COMPLETION OF MOBILIZATION)

HEARING CONSERVATIVE PROGRAM

1.0 MONITORING

As per 29 CFR 1910.95, noise monitoring will be conducted by:

_____ (Name/Title)

Such monitoring will consist of (check those that apply):

___ Sound level meter surveying

___ Noise dosimetry

Specific instrumentation to be used is/are (Make/Model):

_____

_____

_____

and it/they will be calibrated at a frequency of _____ and documented in the _____.

Monitoring strategy is as follows: (List all equipment and activities onsite which may involve sound pressure levels above 80 dBA and an explanation of the strategy to document actual exposures.)

_____

_____

_____

_____

_____

_____

_____

All monitoring will be documented utilizing the format illustrated following Section 7.0 (attach form developed for the specific site). These forms will be maintained in accordance with Section 7.0 of this program.

Monitoring frequency will be _____ and when the following changes in site conditions/activities occur:

_____

_____

_____

_____

2.0 EMPLOYEE NOTIFICATION

All site employees exposed above the OSHA action level (85 dBA - 8 hour TWA) will be notified of the monitoring results by _____ (Name/Title) at an interval not to exceed _____ after completion of monitoring.

Notification shall be (check all that apply):

___ Verbal

___ Written

Documentation of employee notifications and corresponding signatures of notified employees will be kept in the health and safety logbook.

3.0 OBSERVATION OF MONITORING

All employees affected by the monitoring or a designated employee representative shall be given the opportunity to observe noise monitoring procedures. This will be achieved by:

_____

_____

_____

_____

4.0 AUDIOMETRIC TESTING PROGRAM AND REQUIREMENTS

Personnel who perform field activities are required to participate in the medical monitoring program which includes audiometric testing meeting the requirements of OSHA 29 CFR 1910.95. Additionally, any subcontractors performing work on projects where noise levels exceeding 85 dBA will be required to provide documentation that they participate in an audiometric testing program which meets the requirements of 29 CFR 1910.95. Documentation of participation in the testing program will be maintained by _____ and will be located at _____

_____.

5.0 HEARING PROTECTORS AND ESTIMATING ATTENUATION

A selection of suitable hearing protectors will be made available to all employees who are expected to have 8-hour TWA noise exposures above 85 dBA. The types anticipated to be available include:

_____ Attenuation _____

_____ Attenuation _____

_____ Attenuation _____

Hearing protector attenuation will be evaluated by _____ for specific noise environments according to the following method prior to determining their suitability for use:

_____

_____

_____

_____

The following site personnel will be required to wear hearing protectors during specific activities as determined in accordance with 29 CFR 1910.95 and the results of site-specific monitoring conducted according to Section 1.0 of this program. (This section can be completed after monitoring, if necessary.)

Name	Activity	Type of Protection Required

Hearing protectors will be properly fitted by _____ upon initial distribution to site workers. Size and type of protector for each employee fitted will be recorded in the PPE form found in SOP _____.

Training in the use and care of hearing protectors shall be conducted by _____ during the initial site-specific health and safety training (as part of the PPE section) required by the Corporate Health and Safety Manual. Training contents shall be as per the requirements set forth in 29 CFR 1910.120.

Hearing protectors will be distributed by _____ from the storage location at the _____.

6.0 ACCESS TO INFORMATION AND TRAINING MATERIALS

All information required by 29 CFR 1910.95 to be made available to the employees will be posted by _____ (Name/Title) at the _____.

OSHA standard 29 CFR 1910.95 will also be kept onsite.

7.0 RECORDKEEPING

Records required by 29 CFR 1910.95 shall be completed by _____ and maintained at the _____ and placed on permanent file at the _____, for the minimum duration required by the standard.

Employees can access their individual records by contacting _____ (Name/Title).

All records required by this section will be transferred to any employees successive employer if the contractor ceases to do business.

APPENDIX F

OSHA EXCAVATION STANDARDS
29 CFR PART 1926

Subpart P—Excavations

Authority: Sec. 107, Contract Worker Hours and Safety Standards Act (Construction Safety Act) (40 U.S.C. 333); Secs. 4, 6, 8, Occupational Safety and Health Act of 1970 (29 U.S.C. 653, 655, 657); Secretary of Labor's Order No. 12-71 (36 FR 8754), 8-76 (41 FR 25059), or 9-83 (48 FR 35736), as applicable, and 29 CFR part 1911.
[Subpart P authority citation added by 54 FR 45959, October 31, 1989]

§1926.650 Scope, application, and definitions applicable to this subpart.

(a) *Scope and application.* This subpart applies to all open excavations made in the earth's surface. Excavations are defined to include trenches.

(b) *Definitions applicable to this subpart.*

Accepted engineering practices means those requirements which are compatible with standards of practice required by a registered professional engineer.

Aluminum Hydraulic Shoring means a pre-engineered shoring system comprised of aluminum hydraulic cylinders (crossbraces) used in conjunction with vertical rails (uprights) or horizontal rails (walers). Such system is designed, specifically to support the sidewalls of an excavation and prevent cave-ins.

Bell-bottom pier hole means a type of shaft or footing excavation, the bottom of which is made larger than the cross section above to form a belled shape.

Benching (Benching system) means a method of protecting employees from cave-ins by excavating the sides of an excavation to form one or a series of horizontal levels or steps, usually with vertical or near-vertical surfaces between levels.

Cave-in means the separation of a mass of soil or rock material from the side of an excavation, or the loss of soil from under a trench shield or support system, and its sudden movement into the excavation, either by falling or sliding, in sufficient quantity so that it could entrap, bury, or otherwise injure and immobilize a person.

Competent person means one who is capable of identifying existing and predictable hazards in the surroundings, or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.

Cross braces mean the horizontal members of a shoring system installed perpendicular to the sides of the excavation, the ends of which bear against either uprights or wales.

Excavation means any man-made cut, cavity, trench, or depression in an earth surface, formed by earth removal.

Faces or *sides* means the vertical or inclined earth surfaces formed as a result of excavation work.

Failure means the breakage, displacement, or permanent deformation of a structural member or connection so as to reduce its structural integrity and its supportive capabilities.

Hazardous atmosphere means an atmosphere which by reason of being explosive, flammable, poisonous, corrosive, oxidizing, irritating, oxygen deficient, toxic, or otherwise harmful, may cause death, illness, or injury.

Kickout means the accidental release or failure of a cross brace.

Protective system means a method of protecting employees from cave-ins, from material that could fall or roll from an excavation face or into an excavation, or from the collapse of adjacent structures. Protective systems include support systems, sloping and benching systems, shield systems, and other systems that provide the necessary protection.

Ramp means an inclined walking or working surface that is used to gain access to one point from another, and is constructed from earth or from structural materials such as steel or wood.

Registered Professional Engineer means a person who is registered as a professional engineer in the state where the work is to be performed. However, a professional engineer, registered in any state is deemed to be a "registered professional engineer" within the meaning of this standard when approving designs for "manufactured protective systems" or "tabulated data" to be used in interstate commerce.

Sheeting means the members of a shoring system that retain the earth in position and in turn are supported by other members of the shoring system.

Shield (Shield system) means a structure that is able to withstand the forces imposed on it by a cave-in and thereby protect employees within the structure. Shields can be permanent structures or can be designed to be portable and moved along as work progresses. Additionally, shields can be either premanufactured or job-built in accordance with §1926.652 (c)(3) or (c)(4). Shields used in trenches are usually referred to as "trench boxes" or "trench shields."

Shoring (Shoring system) means a structure such as a metal hydraulic, mechanical or timber shoring system that supports the sides of an excavation and which is designed to prevent cave-ins.

Sides. See "Faces."

Sloping (Sloping system) means a method of protecting employees from cave-ins by excavating to form sides of an excavation that are inclined away from the excavation so as to prevent cave-ins. The angle of incline required to prevent a cave-in varies with differences in such factors as the soil type, environmental conditions of exposure, and application of surcharge loads.

Stable rock means natural solid mineral material that can be excavated with vertical sides and will remain intact while exposed. Unstable rock is considered to be stable when the rock material on the side or sides of the excavation is secured against caving-in or movement by rock bolts or by another protective system that has been designed by a registered professional engineer.

Structural ramp means a ramp built of steel or wood, usually used for vehicle access. Ramps made of soil or rock are not considered structural ramps.

Support system means a structure such as underpinning, bracing, or shoring, which provides support to an adjacent structure, underground installation, or the sides of an excavation.

Tabulated data means tables and charts approved by a registered professional engineer and used to design and construct a protective system.

Trench (Trench excavation) means a narrow excavation (in relation to its length) made below the surface of the ground. In general, the depth is greater than the width, but the width of a trench (measured at the bottom) is not greater than 15 feet (4.6m). If forms or other structures are installed or constructed in an excavation so as to reduce the dimension measured from the forms or structure to the side of the excavation to 15 feet (4.6m) or less (measured at the bottom of

the excavation), the excavation is also considered to be a trench.

Trench box. See "Shield."

Trench shield. See "Shield."

Uprights means the vertical members of a trench shoring system placed in contact with the earth and usually positioned so that individual members do not contact each other. Uprights placed so that individual members are closely spaced, in contact with or interconnected to each other, are often called "sheeting."

Wales means horizontal members of a shoring system placed parallel to the excavation face whose sides bear against the vertical members of the shoring system or earth.

§1926.651 General requirements.

(a) *Surface encumbrances.* All surface encumbrances that are located so as to create a hazard to employees shall be removed or supported, as necessary, to safeguard employees.

(b) *Underground installations.* (1) The estimated location of utility installations, such as sewer, telephone, fuel, electric, water lines, or any other underground installations that reasonably may be expected to be encountered during excavation work, shall be determined prior to opening an excavation.

(2) Utility companies or owners shall be contacted within established or customary local response times, advised of the proposed work, and asked to establish the location of the utility underground installations prior to the start of actual excavation. When utility companies or owners cannot respond to a request to locate underground utility installations within 24 hours (unless a longer period is required by state or local law), or cannot establish the exact location of these installations, the employer may proceed, provided the employer does so with caution, and provided detection equipment or other acceptable means to locate utility installations are used.

(3) When excavation operations approach the estimated location of underground installations the exact location of the installations shall be determined by safe and acceptable means.

(4) While the excavation is open, underground installations shall be protected, supported or removed as necessary to safeguard employees.

(c) *Access and egress*—(1) *Structural ramps.* (i) Structural ramps that are used solely by employees as a means of access or egress from excavations shall be designed by a competent person. Structural ramps used for access or egress of equipment shall be designed by a competent person qualified in structural design, and shall be constructed in accordance with the design.

(ii) Ramps and runways constructed of two or more structural members shall have the structural members connected together to prevent displacement.

(iii) Structural members used for ramps and runways shall be of uniform thickness.

(iv) Cleats or other appropriate means used to connect runway structural members shall be attached to the bottom of the runway or shall be attached in a manner to prevent tripping.

(v) Structural ramps used in lieu of steps shall be provided with cleats or other surface treatments on the top surface to prevent slipping.

(2) *Means of egress from trench excavations.* A stairway, ladder, ramp or other safe means of egress shall be located in trench excavations that are 4 feet (1.22 m) or more in depth so as to require no more than 25 feet (7.62 m) of lateral travel for employees.

(d) *Exposure to vehicular traffic.* Employees exposed to public vehicular traffic shall be provided with, and shall wear, warning vests or other suitable garments marked with or made of reflectorized or high-visibility material.

(e) *Exposure to falling loads.* No employee shall be permitted underneath loads handled by lifting or digging equipment. Employees shall be required to stand away from any vehicle being loaded or unloaded to avoid being struck by any spillage or falling materials. Operators may remain in the cabs of vehicles being loaded or unloaded when the vehicles are equipped, in accordance with §1926.601(b)(6), to provide adequate protection for the operator during loading and unloading operations.

(f) *Warning system for mobile equipment.* When mobile equipment is operated adjacent to an excavation, or when such equipment is required to approach the edge of an excavation, and the operator does not have a clear and direct view of the edge of the excavation, a warning system shall be utilized such as barricades, hand or mechanical signals, or stop logs. If possible, the grade should be away from the excavation.

(g) *Hazardous atmospheres*—(1) *Testing and controls.* In addition to the requirements set forth in subparts D and E of this part (29 CFR 1926.50 -1926.107) to prevent exposure to harmful levels of atmospheric contaminants and to assure acceptable atmospheric conditions, the following requirements shall apply:

(i) Where oxygen deficiency (atmospheres containing less than 19.5 percent oxygen) or a hazardous atmosphere exists or could reasonably be expected to exist, such as in excavations in landfill areas or excavations in areas where hazardous substances are stored nearby, the atmospheres in the excavation shall be tested before employees enter excavations greater than 4 feet (1.22 m) in depth.

(ii) Adequate precautions shall be taken to prevent employee exposure to atmospheres containing less than 19.5 percent oxygen and other hazardous atmospheres. These precautions include providing proper respiratory protection or ventilation in accordance with subparts D and E of this part respectively.

(iii) Adequate precaution shall be taken such as providing ventilation, to prevent employee exposure to an atmosphere containing a concentration of a flammable gas in excess of 20 percent of the lower flammable limit of the gas.

(iv) When controls are used that are intended to reduce the level of atmospheric contaminants to acceptable levels, testing shall be conducted as often as necessary to ensure that the atmosphere remains safe.

(2) *Emergency rescue equipment.* (i) Emergency rescue equipment, such as breathing apparatus, a safety harness and line, or a basket stretcher, shall be readily available where hazardous atmospheric conditions exist or may reasonably be expected to develop during work in an excavation. This equipment shall be attended when in use.

(ii) Employees entering bell-bottom pier holes, or other similar deep and confined footing excavations, shall wear a harness with a life-line securely attached to it. The lifeline shall be separate from any line used to handle materials, and shall be individually attended at all times while the employee wearing the lifeline is in the excavation.

(h) *Protection from hazards associated with water accumulation.* (1) Employees shall not work in excavations in which there is accumulated water, or in excavations in which water is accumulating, unless adequate precautions have been taken to protect employees against the hazards posed by water accumulation. The precautions necessary to protect employees adequately vary with each situation, but could include special support or shield systems to protect from cave-ins, water removal to control the level of accumulating water, or use of a safety harness and lifeline.

(2) If water is controlled or prevented from accumulating by the use of water removal equipment, the water removal equipment and operations shall be monitored by a competent person to ensure proper operation.

(3) If excavation work interrupts the natural drainage of surface water (such as streams), diversion ditches, dikes, or other suitable means shall be used to prevent surface water from entering the excavation and to provide adequate drainage of the area adjacent to the excavation. Excavations subject to to runoff from heavy rains will require an inspection by a competent person and compliance with paragraphs (h)(1) and (h)(2) of this section.

(i) *Stability of adjacent structures.* (1) Where the stability of adjoining buildings, walls, or other structures is endangered by excavation operations support

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systems such as shoring, bracing, or underpinning shall be provided to ensure the stability of such structures for the protection of employees.

(2) Excavation below the level of the base or footing of any foundation or retaining wall that could be reasonably expected to pose a hazard to employees shall not be permitted except when:

(i) A support system, such as underpinning, is provided to ensure the safety of employees and the stability of the structure; or

(ii) The excavation is in stable rock; or

(iii) A registered professional engineer has approved the determination that the structure is sufficiently removed from the excavation so as to be unaffected by the excavation activity; or

(iv) A registered professional engineer has approved the determination that such excavation work will not pose a hazard to employees.

(3) Sidewalks, pavements, and appurtenant structure shall not be undermined unless a support system or another method of protection is provided to protect employees from the possible collapse of such structures.

(j) *Protection of employees from loose rock or soil.* (1) Adequate protection shall be provided to protect employees from loose rock or soil that could pose a hazard by falling or rolling from an excavation face. Such protection shall consist of scaling to remove loose material; installation of protective barricades at intervals as necessary on the face to stop and contain falling material; or other means that provide equivalent protection.

(2) Employees shall be protected from excavated or other materials or equipment that could pose a hazard by falling or rolling into excavations. Protection shall be provided by placing and keeping such materials or equipment at least 2 feet (.61 m) from the edge of excavations, or by the use of retaining devices that are sufficient to prevent materials or equipment from falling or rolling into excavations, or by a combination of both if necessary.

(k) *Inspections.* (1) Daily inspections of excavations, the adjacent areas, and protective systems shall be made by a competent person for evidence of a situation that could result in possible cave-ins, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions. An inspection shall be conducted by the competent person prior to the start of work and as needed throughout the shift. Inspections shall also be made after every rainstorm or other hazard increasing occurrence. These inspections are only required when employee exposure can be reasonably anticipated.

(2) Where the competent person finds evidence of a situation that could result in a possible cave-in, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions, exposed employees shall be removed from the hazardous area until the necessary precautions have been taken to ensure their safety.

(l) *Fall protection.* (1) Where employees or equipment are required or permitted to cross over excavations, walkways or bridges with standard guardrails shall be provided.

(2) Adequate barrier physical protection shall be provided at all remotely located excavations. All wells, pits, shafts, etc., shall be barricaded or covered. Upon completion of exploration and similar operations, temporary wells, pits, shafts, etc., shall be backfilled.

§1926.652 Requirements for protective systems.

(a) *Protection of employees in excavations.* (1) Each employee in an excavation shall be protected from cave-ins by an adequate protective system designed in accordance with paragraph (b) or (c) of this section except when:

(i) Excavations are made entirely in stable rock; or

(ii) Excavations are less than 5 feet (1.52 m) in depth and examination of the ground by a competent person provides no indication of a potential cave-in.

(2) Protective systems shall have the capacity to resist without failure all loads that are intended or could reasonably be expected to be applied or transmitted to the system.

(b) *Design of sloping and benching systems.* The slopes and configurations of sloping and benching systems shall be selected and constructed by the employer or his designee and shall be in accordance with the requirements of paragraph (b)(1); or, in the alternative, paragraph (b)(2); or, in the alternative, paragraph (b)(3), or, in the alternative, paragraph (b)(4), as follows:

(1) *Option (1)—Allowable configurations and slopes.* (i) Excavations shall be sloped at an angle not steeper than one and one-half horizontal to one vertical (34 degrees measured from the horizontal), unless the employer uses one of the other options listed below.

(ii) Slopes specified in paragraph (b)(1)(i) of this section, shall be excavated to form configurations that are in accordance with the slopes shown for Type C soil in Appendix B to this subpart.

(2) *Option (2)—Determination of slopes and configurations using Appendices A and B.* Maximum allowable slopes, and allowable configurations for sloping and benching systems, shall be determined in accordance with the conditions and requirements set forth in appendices A and B to this subpart.

(3) *Option (3)—Designs using other tabulated data.* (i) Designs of sloping or benching systems shall be selected from and be in accordance with tabulated data, such as tables and charts.

(ii) The tabulated data shall be in written form and shall include all of the following:

(A) Identification of the parameters that affect the selection of a sloping or benching system drawn from such data;

(B) Identification of the limits of use of the data, to include the magnitude and and configuration of slopes determined to be safe;

(C) Explanatory information as may be necessary to aid the user in making a correct selection of a protective system from the data.

(iii) At least one copy of the tabulated data which identifies the registered professional engineer who approved the data, shall be maintained at the jobsite during construction of the protective system. After that time the data may be stored off the jobsite, but a copy of the data shall be made available to the Secretary upon request.

(4) *Option (4)—Design by a registered professional engineer.* (i) Sloping and benching systems not utilizing Option (1) or Option (2) or Option (3) under paragraph (b) of this section shall be approved by a registered professional engineer.

(ii) Designs shall be in written form and shall include at least the following:

(A) The magnitude of the slopes that were determined to be safe for the particular project;

(B) The configurations that were determined to be safe for the particular project; and

(C) The identity of the registered professional engineer approving the design.

(iii) At least one copy of the design shall be maintained at the jobsite while the slope is being constructed. After that time the design need not be at the jobsite, but a copy shall be made available to the Secretary upon request.

(c) *Design of support systems, shield systems, and other protective systems.* Designs of support systems, shield systems, and other protective systems shall be selected and constructed by the employer or his designee and shall be in accordance with the requirements of paragraph (c)(1); or, in the alternative, paragraph (c)(2); or, in the alternative, paragraph (c)(3); or, in the alternative, paragraph (c)(4) as follows.

(1) *Option (1)—Designs using appendices A, C, and D.* Designs for timber shorting in trenches shall be determined in accordance with the conditions and requirements set forth in appendices A and C to this subpart. Designs for aluminum hydraulic shoring shall be in accordance with paragraph (c)(2) of this section, but if manufacturer's tabulated data cannot be utilized, designs shall be in accordance with appendix D.

(2) *Option (2)—Designs Using Manufacturer's Tabulated Data.* (i) Design of support systems, shield systems, or other protective systems that are drawn from manufacturer's tabulated data shall be in

accordance with all specifications, recommendations, and limitations issued or made by the manufacturer.

(ii) Deviation from the specifications, recommendations, and limitations issued or made by the manufacturer shall only be allowed after the manufacturer issues specific written approval.

(ii) Manufacturer's specifications, recommendations, and limitations, and manufacturer's approval to deviate from the specifications, recommendations, and limitations shall be in written form at the jobsite during construction of the protective system. After that time this data may be stored off the jobsite, but a copy shall be made available to the Secretary upon request.

(3) *Option (3)—Designs using other tabulated data.* (i) Designs of support systems, shield systems, or other protective systems shall be selected from and be in accordance with tabulated data, such as tables and charts.

(ii) The tabulated data shall be in written form and include all of the following:

(A) Identification of the parameters that affect the selection of a protective system drawn from such data;

(B) Identification of the limits of use of the data;

(C) Explanatory information as may be necessary to aid the user in making a correct selection of a protective system from the data.

(iii) At least one copy of the tabulated data, which identifies the registered professional engineer who approved the data, shall be maintained at the jobsite during construction of the protective system. After that time the data may be stored off the jobsite, but a copy of the data shall be made available to the Secretary upon request.

(4) *Option (4)—Design by a registered professional engineer.* (i) Support systems, shield systems, and other protective systems not utilizing Option 1, Option 2 or Option 3, above, shall be approved by a registered professional engineer.

(ii) Designs shall be in written form and shall include the following:

(A) A plan indicating the sizes, types, and configurations of the materials to be used in the protective system; and

(B) The identity of the registered professional engineer approving the design.

(iii) At least one copy of the design shall be maintained at the jobsite during construction of the protective system. After that time, the design may be stored off the jobsite, but a copy of the design shall be made available to the Secretary upon request.

(d) *Materials and equipment.* (1) Materials and equipment used for protective systems shall be free from damage or defects that might impair their proper function.

(2) Manufactured materials and equipment used for protective systems shall be used and maintained in a manner that is consistent with the recommendations of the manufacturer, and in a manner that will prevent employee exposure to hazards.

(3) When material or equipment that is used for protective systems is damaged, a competent person shall examine the material or equipment and evaluate its suitability for continued use. If the competent person cannot assure the material or equipment is able to support the intended loads or is otherwise suitable for safe use, then such material or equipment shall be removed from service, and shall be evaluated and approved by a registered professional engineer before being returned to service.

(e) *Installation and removal of support.*—(1) *General.* (i) Members of support systems shall be securely connected together to prevent sliding, falling, kick-outs, or other predictable failure.

(ii) Support systems shall be installed and removed in a manner that protects employees from cave-ins, structural collapses, or from being struck by members of the support system.

(iii) Individual members of support systems shall not be subjected to loads exceeding those which those members were designed to withstand.

(iv) Before temporary removal of individual members begins, additional precautions shall be taken to ensure the safety of employees, such as installing other structural members to carry the loads imposed on the support system.

(v) Removal shall begin at, and progress from, the bottom of the excavation. Members shall be released slowly so as to note any indication of possible failure of the remaining members of the structure or possible cave-in of the sides of the excavation.

(vi) Backfilling shall progress together with the removal of support systems from excavations.

(2) *Additional requirements for support systems for trench excavations.* (i) Excavation of material to a level no greater than 2 feet (.61 m) below the bottom of the members of a support system shall be permitted, but only if the system is designed to resist the forces calculated for the full depth of the trench, and there are no indications while the trench is open of a possible loss of soil from behind or below the bottom of the support system.

(ii) Installation of a support system shall be closely coordinated with the excavation of trenches.

(f) *Sloping and benching systems.* Employees shall not be permitted to work on the faces of sloped or benched excavations at levels above other employees except when employees at the lower levels are adequately protected from the hazard of falling, rolling, or sliding material or equipment.

(g) *Shield systems*—(1) *General.* (i) Shield systems shall not be subjected to loads exceeding those which the system was designed to withstand.

(ii) Shields shall be installed in a manner to restrict lateral or other hazardous movement of the shield in the event of the application of sudden lateral loads.

(iii) Employees shall be protected from the hazard of cave-ins when entering or exiting the areas protected by shields.

(iv) Employees shall not be allowed in shields when shields are being installed, removed, or moved vertically.

(2) *Additional requirement for shield systems used in trench excavations.* Excavations of earth material to a level not greater than 2 feet (.61 m) below the bottom of a shield shall be permitted, but only if the shield is designed to resist the forces calculated for the full depth of the trench, and there are no indications while the trench is open of a possible loss of soil from behind or below the bottom of the shield.

Appendix A to Subpart P

Soil Classification

(a) *Scope and application*—(1) *Scope.* This appendix describes a method of classifying soil and rock deposits based on site and environmental conditions, and on the structure and composition of the earth deposits. The appendix contains definitions, sets forth requirements, and describes acceptable visual and manual tests for use in classifying soils.

(2) *Application.* This appendix applies when a sloping or benching system is designed in accordance with the requirements set forth in §1926.652(b)(2) as a method of protection for employees from cave-ins. This appendix also applies when timber shoring for excavations is designed as a method of protection from cave-ins in accordance with appendix C to subpart P of part 1926, and when aluminum hydraulic shoring is designed in accordance with appendix D. This Appendix also applies if other protective systems are designed and selected for use from data prepared in accordance with the requirements set forth in §1926.652(c), and the use of the data is predicated on the use of the soil classification system set forth in this appendix.

(b) *Definitions.* The definitions and examples given below are based on, in whole or in part, the following: American Society for Testing Materials (ASTM) Standards D653-85 and D2488; The Unified Soils Classification System, The U.S. Department of Agriculture (USDA) Textural Classification Scheme; and The National Bureau of Standards Report BSS-121.

Cemented soil means a soil in which the particles are held together by a chemical agent, such as calcium carbonate, such that a hand-sized sample cannot be crushed into powder or individual soil particles by finger pressure.

Cohesive soil means clay (fine grained soil), or soil with a high clay content, which has cohesive strength. Cohesive soil does not crumble, can be excavated with vertical sideslopes, and is plastic when moist. Cohesive soil is hard to break up when dry, and exhibits significant cohesion when submerged. Cohesive soils include clayey silt, sandy clay, silty clay, clay and organic clay.

Dry soil means soil that does not exhibit visible signs of moisture content.

Fissured means a soil material that has a tendency to break along definite planes of fracture with little resistance, or a material that exhibits open cracks, such as tension cracks, in an exposed surface.

Granular soil means gravel, sand, or silt, (coarse grained soil) with little or no clay content. Granular soil has no cohesive strength. Some moist granular soils exhibit apparent cohesion. Granular soil cannot be molded when moist and crumbles easily when dry.

Layered system means two or more distinctly different soil or rock types arranged in layers. Micaceous seams or weakened planes in rock or shale are considered layered.

Moist soil means a condition in which a soil looks and feels damp. Moist cohesive soil can easily be shaped into a ball and rolled into small diameter threads before crumbling. Moist granular soil that contains some cohesive material will exhibit signs of cohesion between particles.

Plastic means a property of a soil which allows the soil to be deformed or molded without cracking, or appreciable volume change.

Saturated soil means a soil in which the voids are filled with water. Saturation does not require flow. Saturation, or near saturation, is necessary for the proper use of instruments such as a pocket penetrometer or sheer vane.

Soil classification system means, for the purpose of this subpart, a method of categorizing soil and rock deposits in a hierarchy of Stable Rock, Type A, Type B, and Type C, in decreasing order of stability. The categories are determined based on an analysis of the properties and performance characteristics of the deposits and the environmental conditions of exposure.

Stable rock means natural solid mineral matter that can be excavated with vertical sides and remain intact while exposed.

Submerged soil means soil which is underwater or is free seeping.

Type A means cohesive soils with an unconfined compressive strength of 1.5 ton per square foot (tsf) (144 kPa) or greater. Examples of cohesive soils are: clay, silty clay, sandy clay, clay loam and, in some cases silty clay loam and sandy clay loam. Cemented soils such as caliche and hardpan are also considered Type A. However, no soil is Type A if:

(i) The soil is fissured; or

(ii) The soil is subject to vibration from heavy traffic, pile driving, or similar effects; or

(iii) The soil has been previously disturbed; or

(iv) The soil is part of a sloped, layered system where the layers dip into the excavation on a slope of four horizontal to one vertical (4H: 1V) or greater; or

(v) The material is subject to other factors that would require it to be classified as a less stable material.

Type B means:

(i) Cohesive soil with an unconfined compressive strength greater than 0.5 tsf (48 kPa) but less than 1.5 tsf (144 kPa); or

(ii) Granular cohesionless soils including: angular gravel (similar to crushed rock), silt silt loam, sandy loam and, in some cases silty clay loam and sandy clay loam.

(iii) Previously disturbed soils except those which would otherwise be classed as Type C soil.

(iv) Soil that meets the unconfined compressive strength or cementation requirements for Type A, but is fissured or subject to vibration; or

(v) Dry rock that is not stable; or

(vi) Material that is part of a sloped, layered system where the layers dip into the excavation on a slope less steep than four horizontal to one vertical (4H:1V), but only if the material would otherwise be classified as Type B.

Type C means:

(i) Cohesive soil with an unconfined compressive strength of 0.5 tsf (48 kPa) or less; or

(ii) Granular soils including gravel, sand, and loamy sand, or

(iii) Submerged soil or soil from which water is freely seeping; or

(iv) Submerged rock that is not stable, or

(v) Material in a sloped, layered system where the layers dip into the excavation or a slope of four horizontal to one vertical (4H:1V) or steeper.

Unconfined compressive strength means the load per unit area at which a soil will fail in compression. It can be determined by laboratory testing, or estimated in the field using a pocket penetrometer, by thumb penetration tests, and other methods.

Wet soil means soil that contains significantly more moisture than moist soil, but in such a range of values that cohesive material will slump or begin to flow when vibrated. Granular material that would exhibit cohesive properties when moist will lose those cohesive properties when wet.

(c) *Requirements*—(1) *Classification of soil and rock deposits.* Each soil and rock deposit shall be classified by a competent person as Stable Rock, Type A, Type B, or Type C in accordance with the definitions set forth in paragraph (b) of this appendix.

(2) *Basis of classification.* The classification of the deposits shall be made based on the results of at least one visual and at least one manual analysis. Such analyses shall be conducted by a competent person using tests described in paragraph (d) below, or in other recognized methods of soil classification and testing such as those adopted by the America Society for Testing Materials, or the U.S. Department of Agriculture textural classification system.

(3) *Visual and manual analyses.* The visual and manual analyses, such as those noted as being acceptable in paragraph (d) of this appendix, shall be designed and conducted to provide sufficient quantitative and qualitative information as may be necessary to identify properly the properties, factors, and conditions affecting the classification of the deposits.

(4) *Layered systems.* In a layered system, the system shall be classified in accordance with its weakest layer. However, each layer may be classified individually where a more stable layer lies under a less stable layer.

(5) *Reclassification.* If, after classifying a deposit, the properties, factors, or conditions affecting its classification change in any way, the changes shall be evaluated by a competent person. The deposit shall be reclassified as necessary to reflect the changed circumstances.

(d) *Acceptable visual and manual tests*—(1) *Visual tests.* Visual analysis is conducted to determine qualitative information regarding the excavation site in general, the soil adjacent to the excavation, the soil forming the sides of the open excavation, and the soil taken as samples from excavated material.

(i) Observe samples of soil that are excavated and soil in the sides of the excavation. Estimate the range of particle sizes and the relative amounts of the particle sizes. Soil that is primarily composed of fine-grained material is cohesive material. Soil composed primarily of coarse-grained sand or gravel is granular material.

(ii) Observe soil as it is excavated. Soil that remains in clumps when excavated is cohesive. Soil that breaks up easily and does not stay in clumps is granular.

(iii) Observe the side of the open excavation and the surface area adjacent to the excavation. Crack-like openings such as tension cracks could indicate fissured material. If chunks of soil spall off a vertical side, the soil could be fissured. Small spalls are evidence of moving ground and are indications of potentially hazardous situations.

(iv) Observe the area adjacent to the excavation and the excavation itself for evidence of existing utility and other underground structures, and to identify previously disturbed soil.

(v) Observe the opened side of the excavation to identify layered systems. Examine layered systems to identify if the layers slope toward the excavation. Estimate the degree of slope of the layers.

(vi) Observe the area adjacent to the excavation and the sides of the opened excavation for evidence of surface water, water seeping from the sides of the excavation, or the location of the level of the water table.

(vii) Observe the area adjacent to the excavation and the area within the excavation for sources of vibration that may affect the stability of the excavation face.

(2) *Manual tests.* Manual analysis of soil samples is conducted to determine quantitative as well as qualitative properties of soil and to provide more information in order to classify soil properly.

(i) *Plasticity.* Mold a moist or wet sample of soil into a ball and attempt to roll it into threads as thin as ½-inch in diameter. Cohesive material can be successfully rolled into threads without crumbling. For example, if at least a two inch (50 mm) length of ½-inch thread can be held on one end without tearing, the soil is cohesive.

(ii) *Dry strength.* If the soil is dry and crumbles on its own or with moderate pressure into individual grains or fine powder, it

is granular (any combination of gravel, sand, or silt). If the soil is dry and falls into clumps which break up into smaller clumps, but the smaller clumps can only be broken up with difficulty, it may be clay in any combination with gravel, sand or silt. If the dry soil breaks into clumps which do not break up into small clumps and which can only be broken with difficulty, and there is no visual indication the soil is fissured, the soil may be considered unfissured.

(iii) *Thumb penetration.* The thumb penetration test can be used to estimate the unconfined compressive strength of cohesive soils. (This test is based on the thumb penetration test described in American Society for Testing and Materials (ASTM) Standard designation D2488 —"Standard Recommended Practice for Description of Soils (Visual—Manual Procedure).") Type A soils with an unconfined compressive strength of 1.5 tsf can be readily indented by the thumb; however, they can be penetrated by the thumb only with very great effort. Type C soils with an unconfined compressive strength of 0.5 tsf can be easily penetrated several inches by the thumb, and can be molded by light finger pressure. This test should be conducted on an undisturbed soil sample, such as a large clump of spoil, as soon as practicable after excavation to keep to a minimum the effects of exposure to drying influences. If the excavation is later exposed to wetting influences (rain, flooding), the classification of the soil must be changed accordingly.

(iv) *Other strength tests.* Estimates of unconfined compressive strength of soils can also be obtained by use of a pocket penetrometer or by using a hand-operated shearvane.

(v) *Drying test.* The basic purpose of the drying test is to differentiate between cohesive material with fissures, unfissured cohesive material, and granular material. The procedure for the drying test involves drying a sample of soil that is approximately one inch thick (2.54 cm) and six inches (15.24 cm) in diameter until it is thoroughly dry:

(A) If the sample develops cracks as it dries, significant fissures are indicated.

(B) Samples that dry without cracking are to be broken by hand. If considerable force is necessary to break a sample, the soil has significant cohesive material content. The soil can be classified as an unfissured cohesive material and the unconfined compressive strength should be determined.

(C) If a sample breaks easily by hand, it is either a fissured cohesive material or a granular material. To distinguish between the two, pulverize the dried clumps of the sample by hand or by stepping on them. If the clumps do not pulverize easily, the material is cohesive with fissures. If they pulverize easily into very small fragments, the material is granular.

Appendix B to Subpart P

Sloping and Benching

(a) *Scope and application.* This appendix contains specifications for sloping and benching when used as methods of protecting employees working in excavations from cave-ins. The requirements of this appendix apply when the design of sloping and benching protective systems is to be performed in accordance with the requirements set forth in §1926.652(b)(2).

(b) *Definitions.*

Actual slope means the slope to which an excavation face is excavated.

Distress means that the soil is in a condition where a cave-in is imminent or is likely to occur. Distress is evidenced by such phenomena as the development of fissures in the face of or adjacent to an open excavation; the subsidence of the edge of an excavation; the slumping of material from the face or the bulging or heaving of material from the bottom of an excavation; the spalling of material from the face of an excavation; and ravelling, i.e., small amounts of material such as pebbles or little clumps of material suddenly separating from the face of an excavation and trickling or rolling down into the excavation.

Maximum allowable slope means the steepest incline of an excavation face that is acceptable for the most favorable site conditions as protection against cave-ins, and is expressed as the ratio of horizontal distance to vertical rise (H:V).

Short term exposure means a period of time less than or equal to 24 hours that an excavation is open.

(c) *Requirements*—(1) *Soil classification.* Soil and rock deposits shall be classified in accordance with appendix A to subpart P of part 1926.

(2) *Maximum allowable slope.* The maximum allowable slope for a soil or rock deposit shall be determined from Table B-1 of this appendix.

Table B-1

Maximum Allowable Slopes

SOIL OR ROCK TYPE	MAXIMUM ALLOWABLE SLOPES (H:V) [1] FOR EXCAVATIONS LESS THAN 20 FEET DEEP [3]
STABLE ROCK	VERTICAL (90°)
TYPE A [2]	3/4:1 (53°)
TYPE B	1:1 (45°)
TYPE C	1 1/2:1 (34°)

NOTES:

1. Numbers shown in parentheses next to maximum allowable slopes are angles expressed in degrees from the horizontal. Angles have been rounded off.
2. A short-term maximum allowable slope of 1/2H:1V (63°) is allowed in excavations in Type A soil that are 12 feet (3.67 m) or less in depth. Short-term maximum allowable slopes for excavations greater than 12 feet (3.67 m) in depth shall be 3/4H:1V (53°).
3. Sloping or benching for excavations greater than 20 feet deep shall be designed by a registered professional engineer.

(3) *Actual slope.* (i) The actual slope shall not be steeper than the maximum allowable slope.

(ii) The actual slope shall be less steep than the maximum allowable slope, when there are signs of distress. If that situation occurs, the slope shall be cut back to an actual slope which is at least 1/2 horizontal to one vertical (1/2H:1V) less steep than the maximum allowable slope.

(iii) When surcharge loads from stored material or equipment, operating equipment, or traffic are present, a competent person shall determine the degree to which the actual slope must be reduced below the maximum allowable slope, and shall assure that such reduction is achieved. Surcharge loads from adjacent structures shall be evaluated in accordance with §1926.651(i).

(4) *Configurations.* Configurations of sloping and benching systems shall be in accordance with Figure B-1.

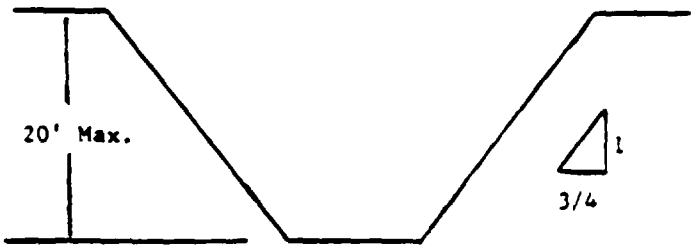
Figure B-1

Slope Configurations

(All slopes stated below are in the horizontal to vertical ratio)

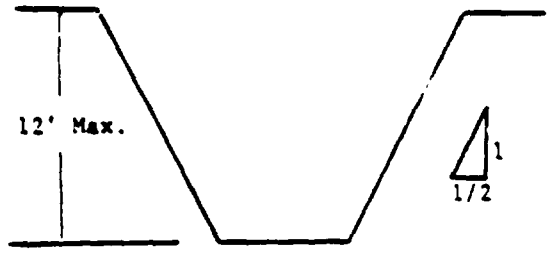
B-1.1 Excavations made in Type A soil.

1. All simple slope excavations 20 feet or less in depth shall have a maximum allowable slope of 3/4:1.



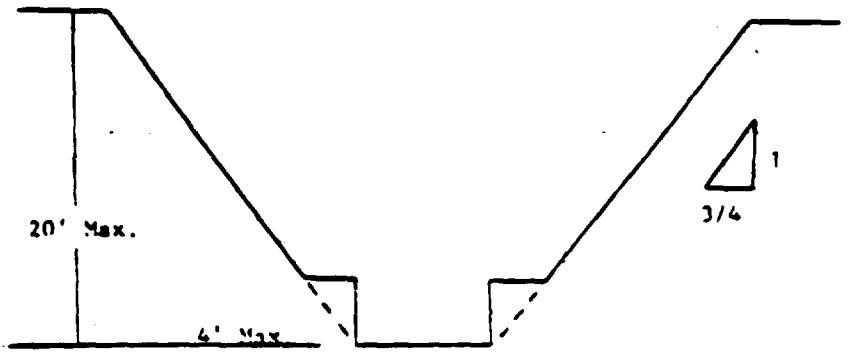
Simple Slope—General

Exception: Simple slope excavations which are open 24 hours or less (short term) and which are 12 feet or less in depth shall have a maximum allowable slope of 1/2:1.



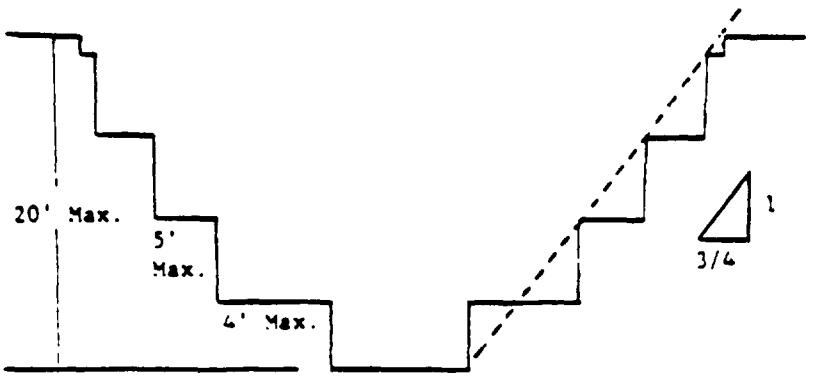
Simple Slope—Short Term

2. All benched excavations 20 feet or less in depth shall have a maximum allowable slope of 3/4 to 1 and maximum bench dimensions as follows:



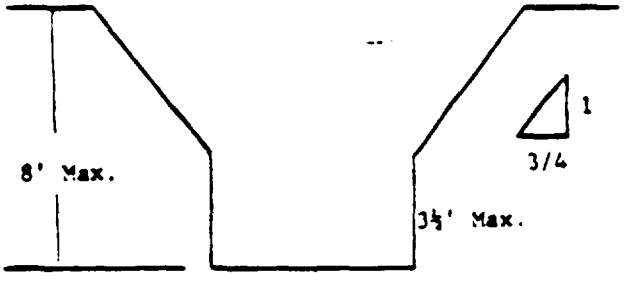
Simple Bench

[Sec. 1926.652, Appendix B]



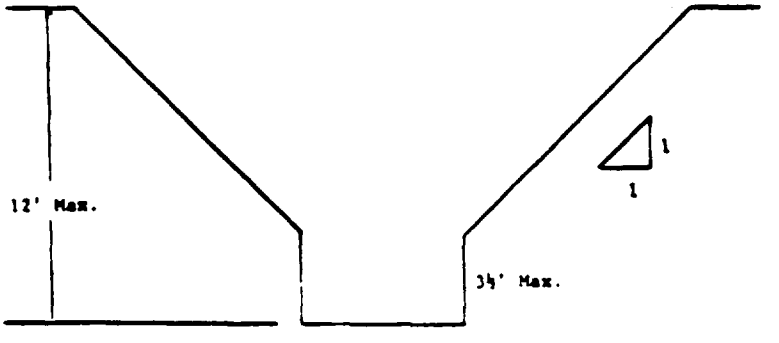
Multiple Bench

3. All excavations 8 feet or less in depth which have unsupported vertically sided lower portions shall have a maximum vertical side of 3½ feet.



Unsupported Vertically Sided Lower Portion—Maximum 8 Feet in Depth

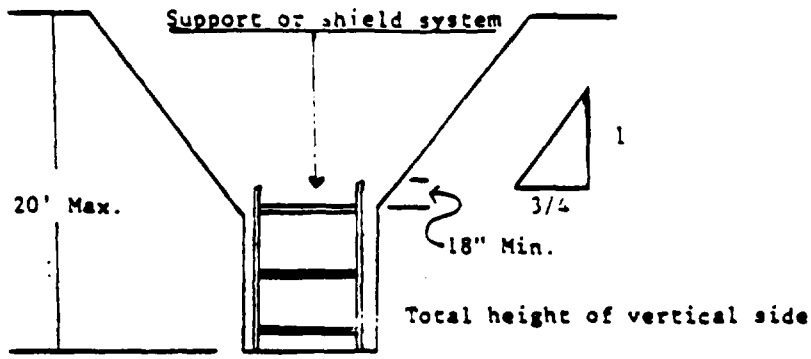
All excavations more than 8 feet but not more than 12 feet in depth which unsupported vertically sided lower portions shall have a maximum allowable slope of 1:1 and a maximum vertical side of 3½ feet.



Unsupported Vertically Sided Lower Portion—Maximum 12 Feet in Depth

[Sec. 1926.652, Appendix B]

All excavations 20 feet or less in depth which have vertically sided lower portions that are supported or shielded shall have a maximum allowable slope of 3/4:1. The support or shield system must extend at least 18 inches above the top of the vertical side.

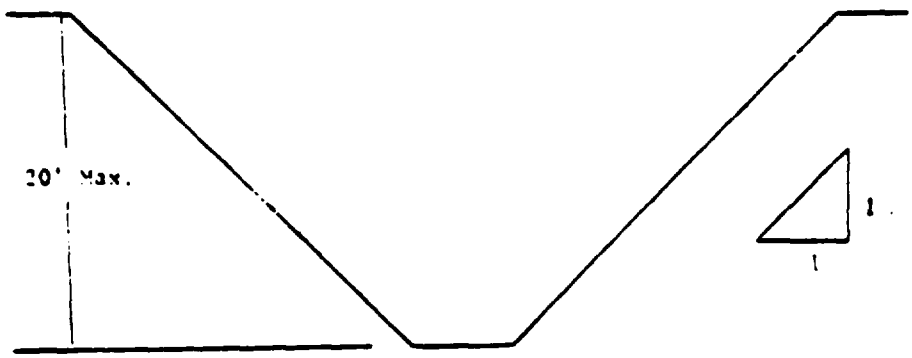


Supported or Shielded Vertically Sided Lower Portion

4. All other simple slope, compound slope, and vertically sided lower portion excavations shall be in accordance with the other options permitted under §1926.652(b).

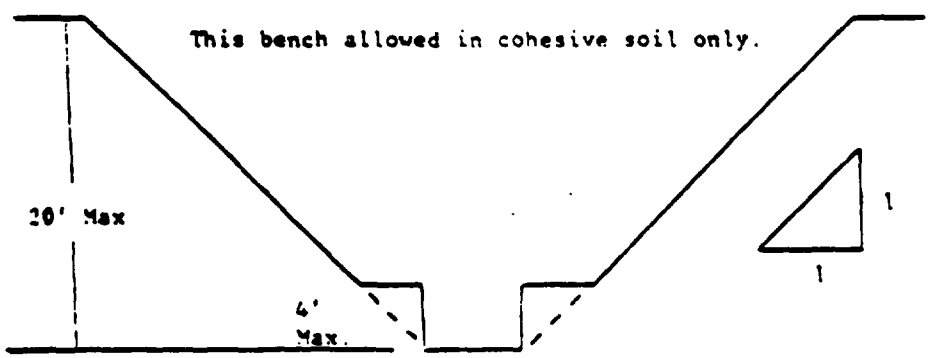
B-1.2 Excavations Made in Type B Soil

1. All simple slope excavations 20 feet or less in depth shall have a maximum allowable slope of 1:1.



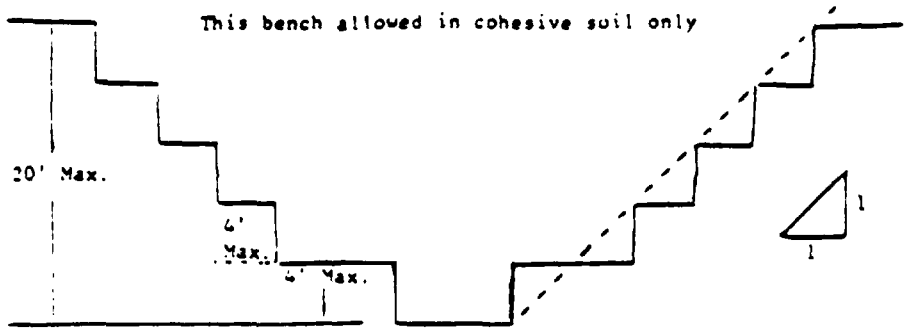
Simple Slope

2. All benched excavations 20 feet or less in depth shall have a maximum allowable slope of 1:1 and maximum bench dimensions as follows:



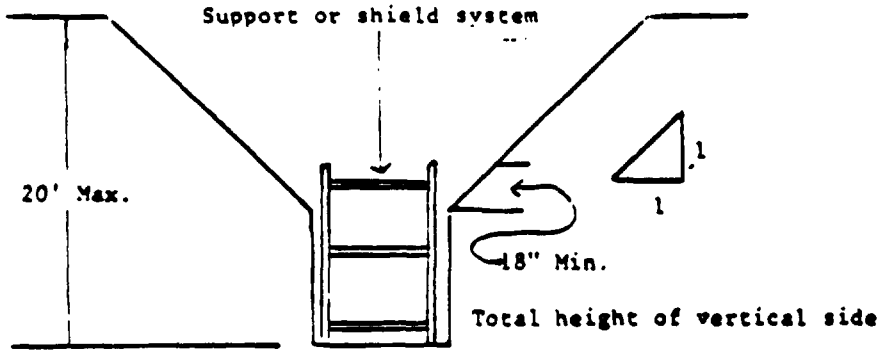
Single Bench

[Sec. 1926.652, Appendix B]



Multiple Bench

3. All excavations 20 feet or less in depth which have vertically sided lower portions shall be shielded or supported to a height at least 18 inches above the top of the vertical side. All such excavations shall have a maximum allowable slope of 1:1.

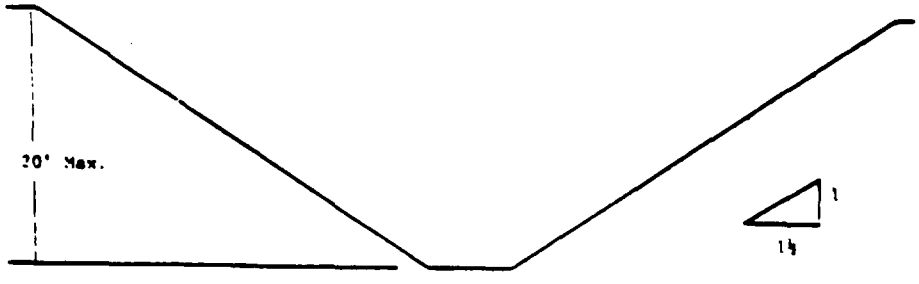


Vertically Sided Lower Portion

4. All other sloped excavations shall be in accordance with the other options permitted §1926.652(b).

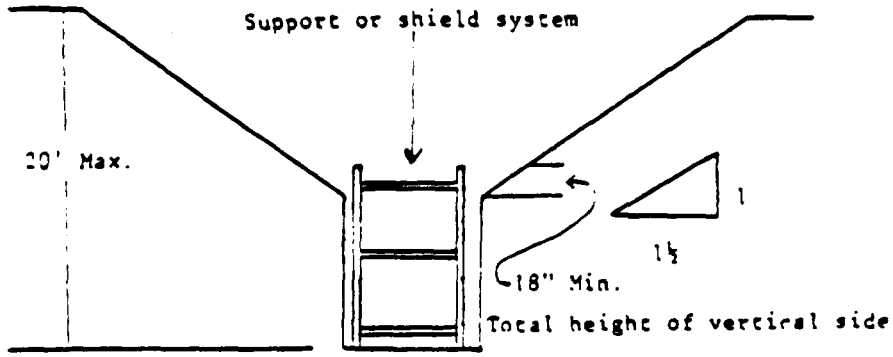
B-1.3 Excavations Made in Type C Soil

1. All simple slope excavations 20 feet or less in depth shall have a maximum allowable slope of 1½:1.



Simple Slope

2. All excavations 20 feet or less in depth which have vertically sided lower portions shall be shielded or supported to a height at least 18 inches above the top of the vertical side. All such excavations shall have a maximum allowable slope of 1½:1.

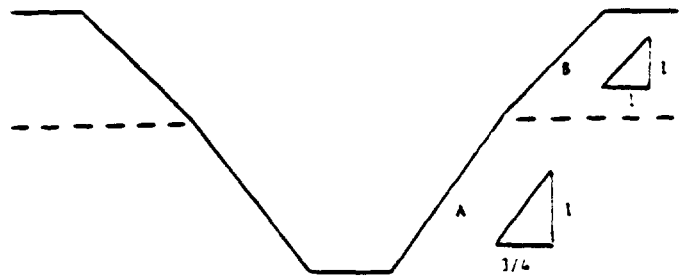


Vertical Sided Lower Portion

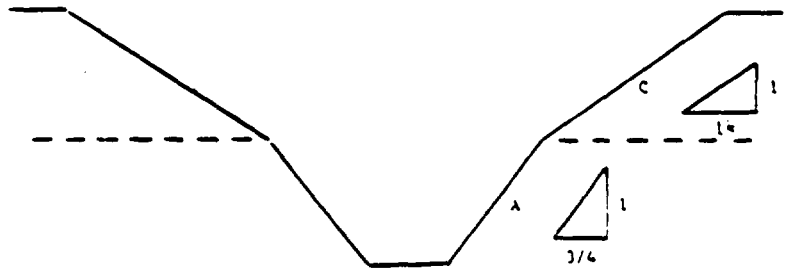
3. All other sloped excavations shall be in accordance with the other options permitted in §1926.652(b).

B-1.4 Excavations Made in Layered Soils

1. All excavations 20 feet or less in depth made in layered soils shall have a maximum allowable slope for each layer as set forth below.

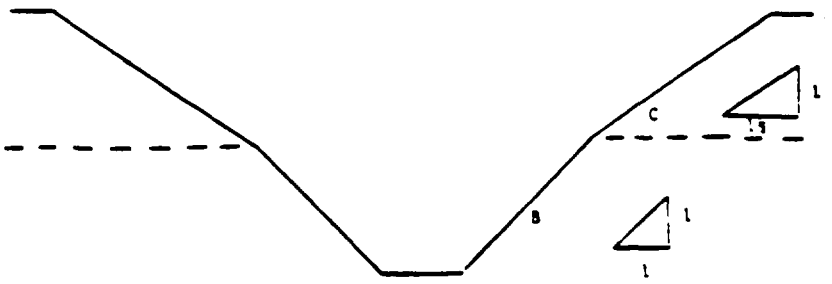


B OVER A

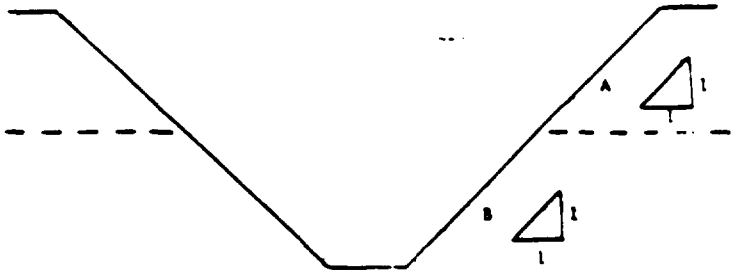


C OVER A

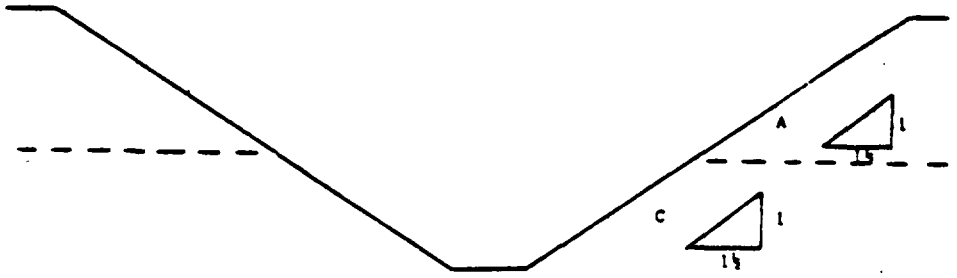
[Sec. 1926.652, Appendix B]



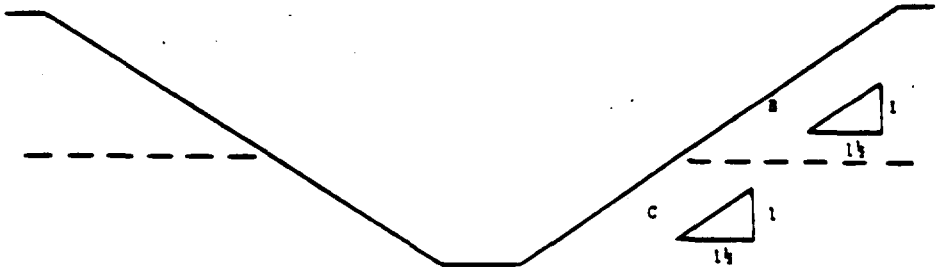
C OVER B



A OVER B



A OVER C



B OVER C

2. All other sloped excavations shall be in accordance with the other options permitted in §1926.652(b).

[Sec. 1926.652, Appendix B]

Appendix C to Subpart P

Timber Shoring for Trenches

(a) *Scope.* This appendix contains information that can be used timber shoring is provided as a method of protection from cave-ins in trenches that do not exceed 20 feet (6.1 m) in depth. This appendix must be used when design of timber shoring protective systems is to be performed in accordance with §1926.652(c)(1). Other timber shoring configurations; other systems of support such as hydraulic and pneumatic systems; and other protective systems such as sloping, benching, shielding, and freezing systems must be designed in accordance with the requirements set forth in §1926.652(b) and §1926.652(c).

(b) *Soil Classification.* In order to use the data presented in this appendix, the soil type or types in which the excavation is made must first be determined using the soil classification method set forth in appendix A of subpart P of this part.

(c) *Presentation of Information.* Information is presented in several forms as follows:

(1) Information is presented in tabular form in Tables C-1.1, C-1.2 and C-1.3, and Tables C-2.1, C-2.2, and C-2.3 following paragraph (g) of the appendix. Each table presents the minimum sizes of timber members to use in a shorting system, and each table contains data only for the particular soil type in which the excavation or portion of the excavation is made. The data are arranged to allow the user the flexibility to select from among several acceptable configurations of members based on varying the horizontal spacing of the crossbraces. Stable rock is exempt from shoring requirements and therefore, no data are presented for this condition.

(2) Information concerning the basis of the tabular data and the limitations of the data is presented in paragraph (d) of this appendix, and on the tables themselves.

(3) Information explaining the use of the tabular data is presented in paragraph (e) of this appendix.

(4) Information illustrating the use of the tabular data is presented in paragraph (f) of this appendix.

(5) Miscellaneous notations regarding Tables C-1.1 through C-1.3 and Tables C-2.1 through C-2.3 are presented in paragraph (g) of this Appendix.

(d) *Basis and limitations of the data.*—(1) *Dimensions of timber members.* (i) The sizes of the timber members listed in Tables C-1.1 through C-1.3. are taken from the National Bureau of Standards (NBS) report, "Recommended Technical Provisions for Construction Practice in Shoring and Sloping of Trenches and Excavations." In addition, where NBS did not recommend specific sizes of members, member sizes are based on an analysis of the sizes required for use by existing codes and on empirical practice.

(ii) The required dimensions of the members listed in Tables C-1.1 through C-1.3 refer to actual dimensions and not nominal dimensions of the timber. Employers wanting to use nominal size shoring are directed to Tables C-2.1 through C-2.3, or have this choice under §1926.652(c)(3), and are referred to The Corps of Engineers. The Bureau of Reclamation or data from other acceptable sources.

(2) *Limitation of application.* (i) It is not intended that the timber shoring specification apply to every situation that may be experienced in the field. These data were developed to apply to the situations that are most commonly experienced in current trenching practice. Shoring systems for use in situations that are not covered by the data in this appendix must be designed as specified in §1926.652(c).

(ii) When any of the following conditions are present, the members specified in the tables are not considered adequate. Either an alternate timber shoring system must be designed or another type of protective system designed in accordance with §1926.652.

(A) When loads imposed by structures or by stored material adjacent to the trench weigh in excess of the load imposed by a two-foot soil surcharge. The term "adjacent" as used here means the area within a horizontal distance from the edge of the trench equal to the depth of the trench.

(B) When vertical loads imposed on cross braces exceed a 240-pound gravity load distributed on a one-foot section of the center of the crossbrace.

(C) When surcharge loads are present from equipment weighing in excess of 20,000 pounds.

(D) When only the lower portion of a trench is shored and the remaining portion of the trench is sloped or benched unless: The sloped portion is sloped at an angle less steep than three horizontal to one vertical; or the members are selected from the tables for use at a depth which is determined from the top of the overall trench, and not from the toe of the sloped portion.

(e) *Use of Tables.* The members of the shoring system that are to be selected using this information are the cross braces, the uprights, and the wales, where wales are required. Minimum sizes of members are specified for use in different types of soil. There are six tables of information, two for each soil type. The soil type must first be determined in accordance with the soil classification system described in appendix A to subpart P of part 1926. Using the appropriate table, the selection of the size and spacing of the members is then made. The selection is based on the depth and width of the trench where the members are to be installed and, in most instances, the selection is also based on the horizontal spacing of the crossbraces. Instances where a choice of horizontal spacing of crossbracing is available, the horizontal spacing of the crossbraces must be chosen by the user before the size of any member can be determined. When the soil type, the width and depth of the trench, and the horizontal spacing of the crossbraces are known, the size and vertical spacing of the wales, and the size and horizontal spacing of the uprights can be read from the appropriate table.

(f) *Examples to Illustrate the Use of Tables C-1.1 through C-1.3.*

(1) *Example 1.*

A trench dug in Type A soil is 13 feet deep and five feet wide.

From *Table C-1.1*, for acceptable arrangements of timber can be used.

Arrangement #1

Space 4×4 crossbraces at six feet horizontally and four feet vertically.

Wales are not required.

Space 3×8 uprights at six feet horizontally. This arrangement is commonly called "skip shoring."

Arrangement # 2

Space 4×6 crossbraces at eight feet horizontally and four feet vertically.

Space 8×8 wales at four feet vertically.

Space 2×6 uprights at four feet horizontally.

Arrangement # 3

Space 6×6 crossbraces at 10 feet horizontally and four feet vertically.

Space 8×10 wales at four feet vertically.

Space 2×6 uprights at five feet horizontally.

Arrangement #4

Space 6×6 crossbraces at 12 feet horizontally and four feet vertically.

Space 10×10 wales at four feet vertically.

Space 3×8 uprights at six feet horizontally.

(2) *Example 2.*

A trench dug in Type B soil in 13 feet deep and five feet wide. From Table C-1.2 three acceptable arrangements of members are listed.

Arrangement # 1

Space 6×6 crossbraces at six feet horizontally and five feet vertically.

Space 8×8 wales at five feet vertically.

Space 2×6 uprights at two feet horizontally.

Arrangement # 2

Space 6×8 crossbraces at eight feet horizontally and five feet vertically.

Space 10×10 wales at five feet vertically.

Space 2×6 uprights at two feet horizontally.

Arrangement # 3

Space 8×8 crossbraces at 10 feet horizontally and five feet vertically.

Space 10×12 wales at five feet vertically.

Space 2×6 uprights at two feet vertically.

(3) *Example 3.*

A trench dug in Type C soil is 13 feet deep and five feet wide.

From Table C-1.3 two acceptable arrangements of members can be used.

Arrangement # 1

Space 8×8 crossbraces at six feet horizontally and five feet vertically.

Space 10×12 wales at five feet vertically.

Position 2×6 uprights as closely together as possible.

If water must be retained use special tongue and groove uprights to form tight sheeting.

Arrangement # 2

Space 8×10 crossbraces at eight feet horizontally and five feet vertically.

Space 12×12 wales at five feet vertically.

Position 2×6 uprights in a close sheeting configuration unless water pressure must be resisted. Tight sheeting must be used where water must be retained.

(4) *Example 4.*

A trench dug in Type C soil is 20 feet deep and 11 feet wide. The size and spacing of members for the section of trench that is over 15 feet in depth is determined using Table C-1.3. Only one arrangement of members is provided.

Space 8×10 crossbraces at six feet horizontally and five feet vertically.

Space 12×12 wales at five feet vertically.

Use 3×6 tight sheeting.

Use of Tables C-2.1 through C-2.3 would follow the same procedures.

(g) *Notes for all Tables.*

1. Member sizes at spacings other than indicated are to be determined as specified in §1926.652(c), "Design of Protective Systems."

2. When conditions are saturated or submerged use Tight Sheeting. Tight Sheeting refers to the use of specially-edged timber planks (e.g., tongue and groove) at least three inches thick, steel sheet piling, or similar construction that when driven or placed in position provide a tight wall to resist the lateral pressure of water and to prevent the loss of backfill material. Close Sheeting refers to the placement of planks side-by-side allowing as little space as possible between them.

3. All spacing indicated is measured center to center.

4. Wales to be installed with greater dimension horizontal.

5. If the vertical distance from the center of the lowest crossbrace to the bottom of the trench exceeds two and one-half feet, uprights shall be firmly embedded or a mudsill shall be used. Where uprights are embedded, the vertical distance from the center of the lowest crossbrace to the bottom of the trench shall not exceed 36 inches. When mudsills are used, the vertical distance shall not exceed 42 inches. Mudsills are wales that are installed at the toe of the trench side.

6. Trench jacks may be used in lieu of or in combination with timber crossbraces.

7. Placement of crossbraces. When the vertical spacing of crossbraces is four feet, place the top crossbrace no more than two feet below the top of the trench. When the vertical spacing of crossbraces is five feet, place the top crossbrace no more than 2.5 feet below the top of the trench.

Table C-1.1
Timber Trench Shoring—Minimum Timber Requirements*
Soil Type A $P_a = 25 \times H + 72$ psf (2 ft Surcharge)

DEPTH OF TRENCH (FEET)	SIZE (ACTUAL) AND SPACING OF MEMBERS**													
	CROSS BRACES							WALES		UPRIGHTS				
	HORIZ. SPACING (FEET)	WIDTH OF TRENCH (FEET)					VERT. SPACING (FEET)	SIZE (IN)	VERT. SPACING (FEET)	MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET)				
		UP TO 4	UP TO 6	UP TO 9	UP TO 12	UP TO 15				CLOSE	4	5	6	8
5 TO 10	UP TO 6	4x4	4x4	4x6	6x6	6x6	4	Not Req'd	—				2x6	
	UP TO 8	4x4	4x4	4x6	6x6	6x6	4	Not Req'd	—					2x8
	UP TO 10	4x6	4x6	4x6	6x6	6x6	4	8x8	4			2x6		
	UP TO 12	4x6	4x6	6x6	6x6	6x6	4	8x8	4				2x6	
10 TO 15	UP TO 6	4x4	4x4	4x6	6x6	6x6	4	Not Req'd	—				3x8	
	UP TO 8	4x6	4x6	6x6	6x6	6x6	4	8x8	4		2x6			
	UP TO 10	6x6	6x3	6x6	6x8	6x8	4	8x10	4			2x6		
	UP TO 12	6x6	6x6	6x6	6x8	6x8	4	10x10	4				3x8	
15 TO 20	UP TO 6	6x6	6x6	6x6	6x8	6x8	4	6x8	4	3x6				
	UP TO 8	6x6	6x6	6x6	6x8	6x8	4	8x8	4	3x6				
	UP TO 10	8x8	8x8	8x8	8x8	8x10	4	8x10	4	3x6				
	UP TO 12	8x8	8x8	8x8	8x8	8x10	4	10x10	4	3x6				
OVER 20	SEE NOTE 1													

* Mixed oak or equivalent with a bending strength not less than 850 psi.
** Manufactured members of equivalent strength may be substituted for wood.

[Sec. 1926.652, Appendix C]

Table C-1.2
Timber Trench Shoring—Minimum Timber Requirements*
Soil Type B $P_a = 45 \times H + 72$ psf (2 ft. Surcharge)

DEPTH OF TRENCH (FEET)	SIZE (ACTUAL) AND SPACING OF MEMBERS**													
	CROSS BRACES						WALES		UPRIGHTS					
	HORIZ. SPACING (FEET)	WIDTH OF TRENCH (FEET)					VERT SPACING (FEET)	SIZE (IN)	VERT SPACING (FEET)	MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET)				
		UP TO 4	UP TO 6	UP TO 9	UP TO 12	UP TO 15				CLOSE	2	3		
5 TO 10	UP TO 6	4×6	4×6	6×6	6×6	6×6	5	6×8	5			2×6		
	UP TO 8	6×6	6×6	6×6	6×8	6×8	5	8×10	5			2×6		
	UP TO 10	6×6	6×6	6×6	6×8	6×8	5	10×10	5			2×6		
	See Note 1													
10 TO 15	UP TO 6	6×6	6×6	6×6	6×8	6×8	5	8×8	5		2×6			
	UP TO 8	6×8	6×8	6×8	8×8	8×8	5	10×10	5		2×6			
	UP TO 10	8×8	8×8	8×8	8×8	8×10	5	10×12	5		2×6			
	See Note 1													
15 TO 20	UP TO 6	6×8	6×8	6×8	8×8	8×8	5	8×10	5	3×6				
	UP TO 8	8×8	8×8	8×8	8×8	8×10	5	10×12	5	3×6				
	UP TO 10	8×10	8×10	8×10	8×10	10×10	5	12×12	5	3×6				
	See Note 1													
OVER 20	SEE NOTE 1													

* Mixed oak or equivalent with a bending strength not less than 850 psi.
** Manufactured members of equivalent strength may be substituted for wood.

[Sec. 1926.652, Appendix C]

Table C-1.3
Timber Trench Shoring—Minimum Timber Requirements*
Soil Type C $P_a = 80 \times H + 72$ psf (2 ft. Surcharge)

DEPTH OF TRENCH (FEET)	SIZE (ACTUAL) AND SPACING OF MEMBERS**													
	CROSS BRACES								UPRIGHTS					
	HORIZ. SPACING (FEET)	WIDTH OF TRENCH (FEET)					VERT. SPACING (FEET)	SIZE (IN)	VERT. SPACING (FEET)	MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET) (See Note 2)				
		UP TO 4	UP TO 6	UP TO 9	UP TO 12	UP TO 15				CLOSE				
5 TO 10	UP TO 6	6x8	6x8	6x8	8x8	8x8	5	8x10	5	2x6				
	UP TO 8	8x8	8x8	8x8	8x8	8x10	5	10x12	5	2x6				
	UP TO 10	8x10	8x10	8x10	8x10	10x10	5	12x12	5	2x6				
	See Note 1													
10 TO 15	UP TO 6	8x8	8x8	8x8	8x8	8x10	5	10x12	5	2x6				
	UP TO 8	8x10	8x10	8x10	8x10	10x10	5	12x12	5	2x6				
	See Note 1													
	See Note 1													
15 TO 20	UP TO 6	8x10	8x10	8x10	8x10	10x10	5	12x12	5	2x6				
	See Note 1													
	See Note 1													
	See Note 1													
OVER 20	SEE NOTE 1													

* Mixed oak or equivalent with a bending strength not less than 850 psi.
** Manufactured members of equivalent strength may be substituted for wood.

[Sec. 1926.652, Appendix C]

Table C-2.1
Timber Trench Shoring—Minimum Timber Requirements*
Soil Type A $P_s = 25 \times H + 72$ psf (2 ft. Surcharge)

DEPTH OF TRENCH (FEET)	SIZE (S4S) AND SPACING OF MEMBERS**												
	CROSS BRACES						WALES		UPRIGHTS				
	HORIZ. SPACING (FEET)	WIDTH OF TRENCH (FEET)					VERT SPACING (FEET)	SIZE (IN)	VERT SPACING (FEET)	MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET)				
		UP TO 4	UP TO 6	UP TO 9	UP TO 12	UP TO 15				CLOSE	4	5	6	8
5 TO 10	UP TO 6	4x4	4x4	4x4	4x4	4x6	4	Not Req'd	Not Req'd				4x6	
	UP TO 8	4x4	4x4	4x4	4x6	4x6	4	Not Req'd	Not Req'd					4x8
	UP TO 10	4x6	4x6	4x6	6x6	6x6	4	8x8	4			4x6		
	UP TO 12	4x6	4x6	4x6	6x6	6x6	4	8x8	4				4x6	
10 TO 15	UP TO 6	4x4	4x4	4x4	6x6	6x6	4	Not Req'd	Not Req'd				4x10	
	UP TO 8	4x6	4x6	4x6	6x6	6x6	4	6x8	4		4x6			
	UP TO 10	6x6	6x6	6x6	6x6	6x6	4	8x8	4			4x8		
	UP TO 12	6x6	6x6	6x6	6x6	6x6	4	8x10	4		4x6		4x10	
15 TO 20	UP TO 6	6x6	6x6	6x6	6x6	6x6	4	6x8	4	3x6				
	UP TO 8	6x6	6x6	6x6	6x6	6x6	4	8x8	4	3x6	4x12			
	UP TO 10	6x6	6x6	6x6	6x6	6x8	4	8x10	4	3x6				
	UP TO 12	6x6	6x6	6x6	6x8	6x8	4	8x12	4	3x6	4x12			
OVER 20	SEE NOTE 1													

* Douglas fir or equivalent with a bending strength not less than 1500 psi

** Manufactured members of equivalent strength may be substituted for wood

Table C-2.2
Timber Trench Shoring—Minimum Timber Requirements*
Soil Type B $P_a = 45 \times H + 72$ psf (2 ft. Surcharge)

DEPTH OF TRENCH (FEET)	SIZE (S4S) AND SPACING OF MEMBERS**												
	CROSS BRACES						WALES		UPRIGHTS				
	HORIZ. SPACING (FEET)	WIDTH OF TRENCH (FEET)					VERT SPACING (FEET)	SIZE (IN)	VERT. SPACING (FEET)	MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET)				
		UP TO 4	UP TO 6	UP TO 9	UP TO 12	UP TO 15				CLOSE	2	3	4	5
5 TO 10	UP TO 6	4×6	4×6	4×6	6×6	6×6	5	6×8	5			3×12 4×8		4×12
	UP TO 9	4×6	4×6	6×6	6×6	6×6	5	8×8	5		3×9		4×8	
	UP TO 10	4×6	4×6	6×6	6×6	6×8	5	8×10	5			4×8		
	See Note 1													
10 TO 15	UP TO 6	6×6	6×6	6×6	6×8	6×8	5	8×8	5	3×6	4×10			
	UP TO 8	6×8	6×8	6×8	8×8	8×8	5	10×10	5	3×6	4×10			
	UP TO 10	6×8	6×8	8×8	8×8	8×8	5	10×12	5	3×6	4×10			
	See Note 1													
15 TO 20	UP TO 6	6×8	6×8	6×8	6×8	8×8	5	8×10	5	4×6				
	UP TO 8	6×8	6×8	6×8	8×8	8×8	5	10×12	5	4×6				
	UP TO 10	8×8	8×8	8×8	8×8	8×8	5	12×12	5	4×6				
	See Note 1													
OVER 20	SEE NOTE 1													

* Douglas fir or equivalent with a bending strength not less than 1500 psi.
** Manufactured members of equivalent strength may be substituted for wood.

[Sec. 1926.652, Appendix C]

Table C-2.3
Timber Trench Shoring—Minimum Timber Requirements*
Soil Type C $P_a = 80 \times H + 72$ psf (2 ft. Surcharge)

DEPTH OF TRENCH (FEET)	SIZE (ACTUAL) AND SPACING OF MEMBERS**													
	CROSS BRACES						WALES		UPRIGHTS					
	HORIZ. SPACING (FEET)	WIDTH OF TRENCH (FEET)					VERT. SPACING (FEET)	SIZE (IN)	VERT. SPACING (FEET)	MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET)				
		UP TO 4	UP TO 6	UP TO 9	UP TO 12	UP TO 15				CLOSE				
5 TO 10	UP TO 6	6×6	6×6	6×6	6×6	8×8	5	8×8	5	3×6				
	UP TO 8	6×6	6×6	6×6	8×8	8×8	5	10×10	5	3×6				
	UP TO 10	6×6	6×6	8×8	8×8	8×8	5	10×12	5	3×6				
	See Note 1													
10 TO 15	UP TO 6	6×8	6×8	6×8	8×8	8×8	5	10×10	5	4×6				
	UP TO 8	8×8	8×8	8×8	8×8	8×8	5	12×12	5	4×6				
	See Note 1													
	See Note 1													
15 TO 20	UP TO 6	8×8	8×8	8×8	8×10	8×10	5	10×12	5	4×6				
	See Note 1													
	See Note 1													
	See Note 1													
OVER 20	SEE NOTE 1													

* Douglas fir or equivalent with a bending strength not less than 1500 psi.
** Manufactured members of equivalent strength may be substituted for wood.

[Sec. 1926.652, Appendix C]

Appendix D To Subpart P

Aluminum Hydraulic Shoring for Trenches

(a) *Scope.* This appendix contains information that can be used when aluminum hydraulic shoring is provided as a method of protection against cave-ins in trenches that do not exceed 20 feet (6.1m) in depth. This appendix must be used when design of the aluminum hydraulic protective system cannot be performed in accordance with §1926.652(c)(2).

(b) *Soil Classification.* In order to use data presented in this appendix, the soil type or types in which the excavation is made must first be determined using the soil classification method set forth in appendix A of subpart P of part 1926.

(c) *Presentation of Information.* Information is presented in several forms as follows:

(1) Information is presented in tabular form in Tables D-1.1, D -1.2, D -1.3 and E -1.4. Each table presents the maximum vertical and horizontal spacings that may be used with various aluminum member sizes and various hydraulic cylinder sizes. Each table contains data only for the particular soil type in which the excavation or portion of the excavation is made. Tables D-1.1 and D -1.2 are for vertical shores in Types A and B soil. Tables D-1.3 and D -1.4 are for horizontal waler systems in Types B and C soil.

(2) Information concerning the basis of the tabular data and the limitations of the data is presented in paragraph (d) of this appendix.

(3) Information explaining the use of the tabular data is presented in paragraph (e) of this appendix.

(4) Information illustrating the use of the tabular data is presented in paragraph (f) of this appendix.

(5) Miscellaneous notations (footnotes) regarding Table D-1.1 through D -1.4 are presented in paragraph (g) of this appendix.

(6) Figures, illustrating typical installations of hydraulic shoring, are included just prior to the Tables. The illustrations page is entitled "Aluminum Hydraulic Shoring: Typical Installations."

(d) *Basis and limitations of the data.*

(1) Vertical shore rails and horizontal wales are those that meet the Section Modulus requirements in the D-1 Tables. Aluminum material is 6060 -T6 or material of equivalent strength and properties.

(2) Hydraulic cylinders specifications. (i) 2-inch cylinders shall be a minimum safe working capacity of no less than 18,000 pounds axial compressive load at maximum extension. Maximum extension is to include full range of cylinder extensions as recommended by product manufacturer.

(ii) 3-inch cylinders shall be a minimum 3-inch inside diameter with a safe working capacity of not less than 30,000 pounds axial compressive load at extensions as recommended by product manufacturer.

(3) Limitation of application.

(i) It is not intended that the aluminum hydraulic specification apply to every situation that may be experienced in the field. These data were developed to apply to the situations that are most commonly experienced in current trenching practice. Shoring systems for use in situations that are not covered by the data in this appendix must be otherwise designed as specified in §1926.652(c).

(ii) When any of the following conditions are present, the members specified in the Tables are not considered adequate. In this case, an alternative aluminum hydraulic shoring system or other type of protective system must be designed in accordance with §1926.652.

(A) When vertical loads imposed on cross braces exceed a 100 Pound gravity load distributed on a one foot section of the center of the hydraulic cylinder.

(B) When surcharge loads are present from equipment weighing in excess of 20,000 pounds.

(C) When only the lower portion or a trench is shored and the remaining portion of the trench is sloped or benched unless: The sloped portion is sloped at an angle less steep than three horizontal to one vertical; or the members are selected from the tables for use at a depth which is determined from the top of the overall trench, and not from the toe of the sloped portion.

(e) *Use of Tables D-1.2, D-1.3 and D-1.4.* The members of the shoring system that are to be selected using this information are the hydraulic cylinders, and either the vertical shores or the horizontal wales. When a waler system is used the vertical timber sheeting to be used is also selected from these tables. The Tables D-1.1 and D -1.2 for vertical shores are used in Type A and B soils that do not require sheeting. Type B soils that may require sheeting, and Type C soils that always require sheeting are found in the horizontal wale Tables D-1.3 and D -1.4. The soil type must first be determined in accordance with the soil classification system described in appendix A to subpart P of part 1926. Using the appropriate table, the selection of the size and spacing of the members is made. The selection is based on the depth and width of the trench where the members are to be installed. In these tables the vertical spacing is held constant at four feet on center. The tables show the maximum horizontal spacing of cylinders allowed for each size of wale in the waler system tables, and in the vertical shore tables, the hydraulic cylinder horizontal spacing is the same as the vertical shore spacing.

(f) *Example to Illustrate the Use of the Tables:*

(1) Example 1:

A trench dug in Type A soil is 6 feet deep and 3 feet wide. From Table D -1.1: Find vertical shores and 2 inch diameter cylinders spaced 8 feet on center (o.c.) horizontally and 4 feet on center (o.c.) vertically. (See Figures 1 & 3 for typical installations.)

(2) Example 2:

A trench is dug in Type B soil that does not require sheeting, 13 feet deep and 5 feet wide. From Table D -1.2: Find vertical shores and 2 inch diameter cylinders spaced 6.5 feet o.c. horizontally and 4 feet o.c. vertically. (See Figures 1 & 3 for typical installations.)

(3) A trench is dug in Type B soil that does not require sheeting, but does experience some minor raveling of the trench face. The trench is 16 feet deep and 9 feet wide. From Table D -1.2: Find vertical shores and 2 inch diameter cylinder (with special oversleeves as designated by footnote # 2) spaced 5.5 feet o.c. horizontally and 4 feet o.c. vertically, plywood (per footnote (g)(7) to the D -1 Table) should be used behind the shores. (See Figures 2 & 3 for typical installations.)

(4) Example 4: A trench is dug in previously disturbed Type B soil, with characteristics of a Type C soil, and will require sheeting. The trench is 18 feet deep and 12 feet wide. 8 foot horizontal spacing between cylinders is desired for working space. From Table D -1.3: Find horizontal wale with a section modulus of 14.0 spaced at 4 feet o.c. vertically and 3 inch diameter cylinder spaced at 9 feet maximum o.c. horizontally. 3×12 timber sheeting is required at close spacing vertically. (See Figure 4 for typical installation.)

(5) Example 5: A trench is dug in Type C soil, 9 feet deep and 4 feet wide. Horizontal cylinder spacing in excess of 6 feet is desired for working space. From Table D -1.4: Find horizontal wale with a section modulus of 7.0 and 2 inch diameter cylinders spaced at 6.5 feet o.c. horizontally. Or, find horizontal wale with a 14.0 section modulus and 3 inch diameter cylinder spaced at 10 feet o.c. horizontally. Both wales are spaced 4 feet o.c. vertically. 3×12 timber sheeting is required at close spacing vertically. (See Figure 4 for typical installation.)

(g) *Footnotes, and general notes, for Tables D-1.1, D-1.2, D -1.3, and D-1.4.*

(1) For applications other than those listed in the tables, refer to §1926.652(c)(2) for use of manufacturer's tabulated data. For trench depths in excess of 20 feet, refer to §1926.652(c)(2) and §1926.652(c)(3).

(2) 2 inch diameter cylinders, at this width, shall have structural steel tube (3.5×3.5×0.1875) oversleeves, or structural oversleeves of manufacturer's specification, extending the full, collapsed length.

(3) Hydraulic cylinders capacities. (i) 2 inch cylinders shall be a minimum 2-inch inside diameter with a safe working capacity of not less than 18,000 pounds axial compressive load at maximum extension. Maximum extension is to include full range of cylinder extensions as recommended by product manufacturer.

(ii) 3-inch cylinders shall be a minimum 3-inch inside diameter with a safe work capacity of not less than 30,000 pounds axial compressive load at maximum extension Maximum extension is to include full range of cylinder extensions as recommended by product manufacturer.

(4) All spacing indicated is measured center to center.

(5) Vertical shorting rails shall have a minimum section modulus of 0.40 inch.

(6) When vertical shores are used, there must be a minimum of three shores spaced equally, horizontally, in a group.

(7) Plywood shall be 1.125 in. thick softwood or 0.75 inch, thick, 14 ply, arctic white birch (Finland form). Please note that plywood is not intended as a structural member, but only for prevention of local raveling (sloughing of the trench face) between shores.

(8) See appendix C for timber specifications.

(9) Wales are calculated for simple span conditions.

(10) See appendix D, item (d), for basis and limitations of the data.

Aluminum Hydraulic Shoring
Typical Installations

FIGURE NO. 1

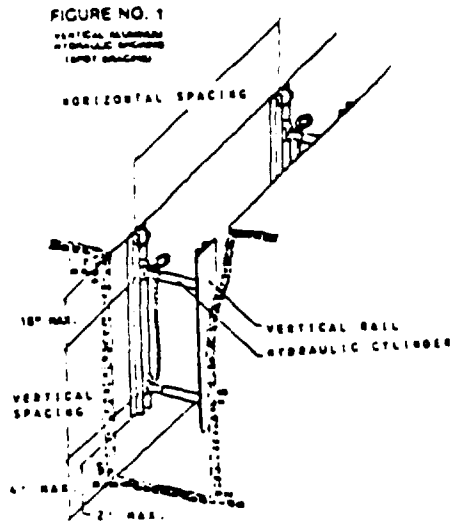


FIGURE NO. 2

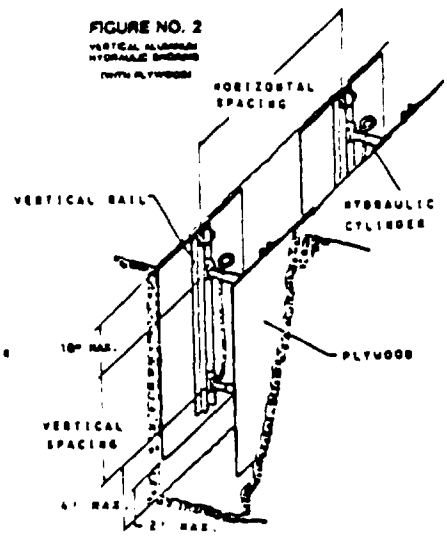


FIGURE NO. 3

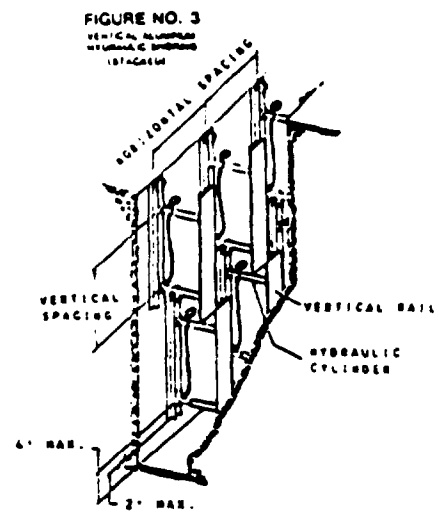


FIGURE NO. 4

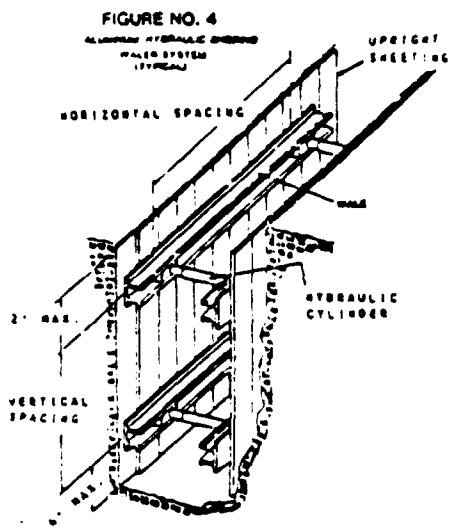


Table D-1.1
Aluminum Hydraulic Shoring
Vertical Shores
For Soil Type A

DEPTH OF TRENCH (FEET)	HYDRAULIC CYLINDERS				
	MAXIMUM HORIZONTAL SPACING (FEET)	MAXIMUM VERTICAL SPACING (FEET)	WIDTH OF TRENCH (FEET)		
			UP TO 8	OVER 8 UP TO 12	OVER 12 UP TO 15
OVER 5 UP TO 10	8	4	2 INCH DIAMETER	2 INCH DIAMETER NOTE (2)	3 INCH DIAMETER
OVER 10 UP TO 15	8				
OVER 15 UP TO 20	7				
OVER 20	NOTE (1)				

Footnotes to tables, and general notes on hydraulic shoring, are found in Appendix D, Item (g)
Note (1): See Appendix D, Item (g)(1)
Note (2): See Appendix D, Item (g)(2)

Table D-1.2
Aluminum Hydraulic Shoring
Vertical Shores
For Soil Type B

DEPTH OF TRENCH (FEET)	HYDRAULIC CYLINDERS				
	MAXIMUM HORIZONTAL SPACING (FEET)	MAXIMUM VERTICAL SPACING (FEET)	WIDTH OF TRENCH (FEET)		
			UP TO 8	OVER 8 UP TO 12	OVER 12 UP TO 15
OVER 5 UP TO 10	8	4	2 INCH DIAMETER	2 INCH DIAMETER NOTE (2)	3 INCH DIAMETER
OVER 10 UP TO 15	6.5				
OVER 15 UP TO 20	5.5				
OVER 20	NOTE (1)				

Footnotes to tables, and general notes on hydraulic shoring, are found in Appendix D, Item (g)
Note (1): See Appendix D, Item (g)(1)
Note (2): See Appendix D, Item (g)(2)

[Sec. 1926.652, Appendix D]

Table D-1.3
Aluminum Hydraulic Shoring
Waler Systems
For Soil Type B

DEPTH OF TRENCH (FEET)	WALES		HYDRAULIC CYLINDERS						TIMBER UPRIGHTS		
			WIDTH OF TRENCH (FEET)						MAX. HORIZ. SPACING (ON CENTER)		
	VERTICAL SPACING (FEET)	SECTION MODULUS* (IN^3)	UP TO 8		OVER 8 UP TO 12		OVER 12 UP TO 15		SOLID SHEET	2 FT	3 FT
			HORIZ. SPACING	CYLINDER DIAMETER	HORIZ. SPACING	CYLINDER DIAMETER	HORIZ. SPACING	CYLINDER DIAMETER			
OVER 5 UP TO 10	4	3.5	8.0	2 IN	8.0	2 IN NOTE (2)	8.0	3 IN	—	—	3×12
		7.0	9.0	2 IN	9.0	2 IN NOTE (2)	9.0	3 IN			
		14.0	12.0	3 IN	12.0	3 IN	12.0	3 IN			
OVER 10 UP TO 15	4	3.5	6.0	2 IN	6.0	2 IN NOTE (2)	6.0	3 IN	—	3×12	—
		7.0	8.0	3 IN	8.0	3 IN	8.0	3 IN			
		14.0	10.0	3 IN	10.0	3 IN	10.0	3 IN			
OVER 15 UP TO 20	4	3.5	5.5	2 IN	5.5	2 IN NOTE (2)	5.5	3 IN	3×12	—	—
		7.0	6.0	3 IN	6.0	3 IN	6.0	3 IN			
		14.0	9.0	3 IN	9.0	3 IN	9.0	3 IN			
OVER 20	NOTE (1)										

Footnotes to tables, and general notes on hydraulic shoring, are found in Appendix D, Item (g)
Notes (1): See Appendix D, item (g)(1)
Notes (2): See Appendix D, item (g)(2)
* Consult product manufacturer and/or qualified engineer for Section Modulus of available wales.

Table D-1.4
Aluminum Hydraulic Shoring
Waler Systems
For Soil Type C

DEPTH OF TRENCH (FEET)	WALES		HYDRAULIC CYLINDERS						TIMBER UPRIGHTS		
			WIDTH OF TRENCH (FEET)						MAX. HORIZ. SPACING (ON CENTER)		
	VERTICAL SPACING (FEET)	* SECTION MODULUS (IN^3)	UP TO 8		OVER 8 UP TO 12		OVER 12 UP TO 15		SOLID SHEET	2 FT	3 FT
			HORIZ. SPACING	CYLINDER DIAMETER	HORIZ. SPACING	CYLINDER DIAMETER	HORIZ. SPACING	CYLINDER DIAMETER			
OVER 5 UP TO 10	4	3.5	6.0	2 IN	6.0	2 IN NOTE (2)	6.0	3 IN	3×12	—	—
		7.0	6.5	2 IN	6.5	2 IN NOTE (2)	6.5	3 IN			
		14.0	10.0	3 IN	10.0	3 IN	10.0	3 IN			
OVER 10 UP TO 15	4	3.5	4.0	2 IN	4.0	2 IN NOTE (2)	4.0	3 IN	3×12	—	—
		7.0	5.5	3 IN	5.5	3 IN	5.5	3 IN			
		14.0	8.0	3 IN	8.0	3 IN	8.0	3 IN			
OVER 15 UP TO 20	4	3.5	3.5	2 IN	3.5	2 IN NOTE (2)	3.5	3 IN	3×12	—	—
		7.0	5.0	3 IN	5.0	3 IN	5.0	3 IN			
		14.0	6.0	3 IN	6.0	3 IN	6.0	3 IN			
OVER 20	NOTE (1)										

Footnotes to tables, and general notes on hydraulic shoring, are found in Appendix D, Item (g)
Notes (1): See Appendix D, item (g)(1)
Notes (2): See Appendix D, item (g)(2)
* Consult product manufacturer and/or qualified engineer for Section Modulus of available wales.

[Sec. 1926.652, Appendix D]

Appendix E to Subpart P—Alternatives to Timber Shoring

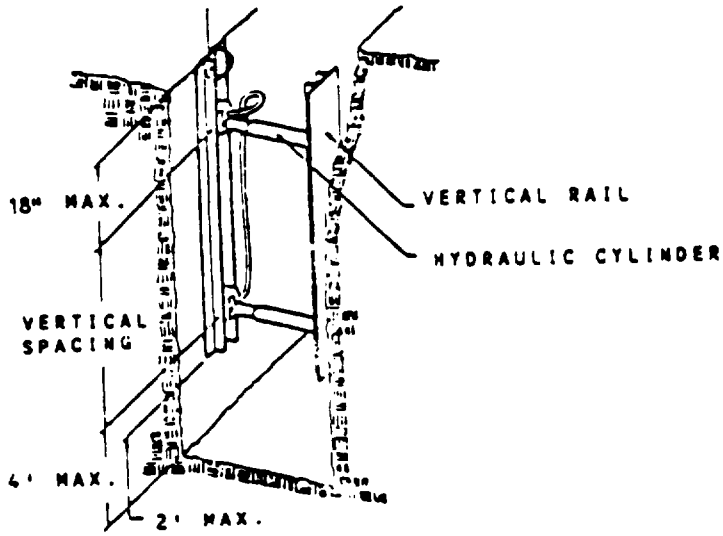


Figure 1. Aluminum Hydraulic Shoring

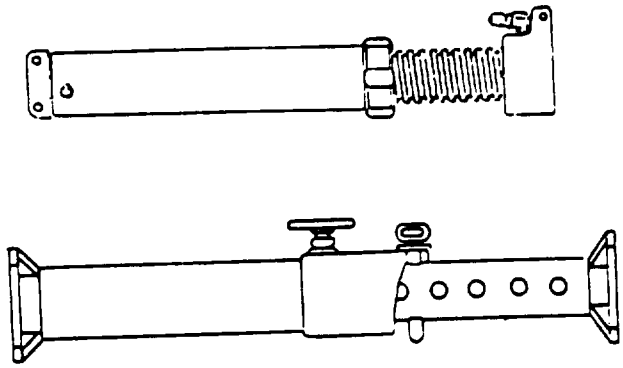


Figure 2. Pneumatic/Hydraulic Shoring

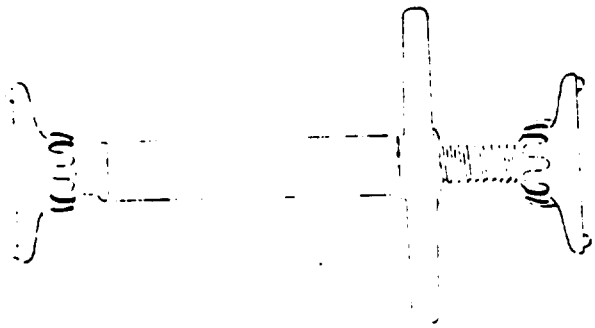


Figure 3. Trench Jacks (Screw Jacks)

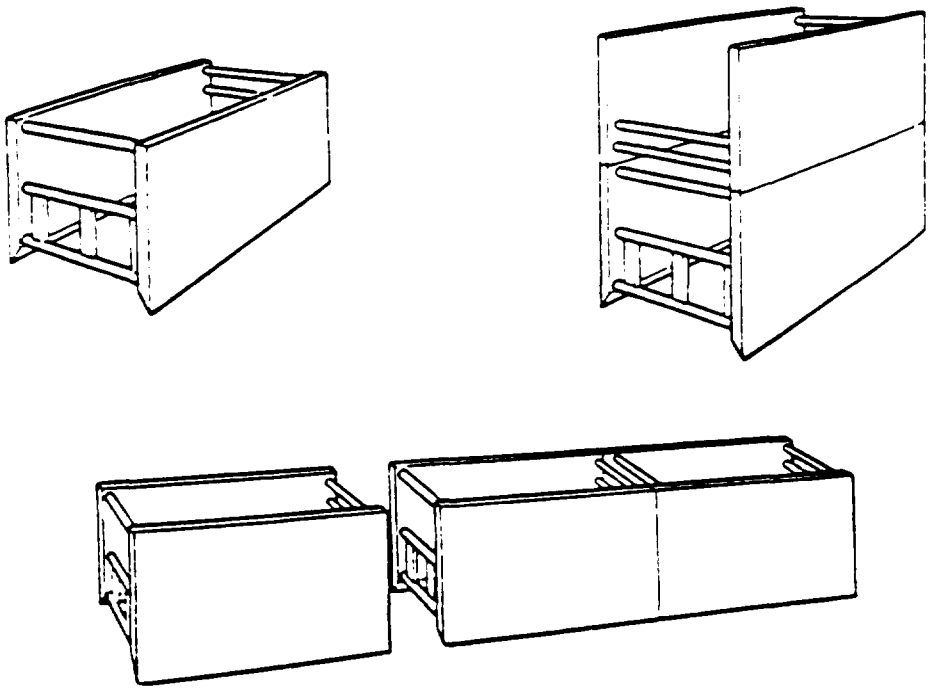


Figure 4. Trench Shields

Appendix F to Subpart P—Selection of Protective Systems

The following figures are a graphic summary of the requirements contained in subpart P for excavations 20 feet or less in depth. Protective systems for use in excavations more than 20 feet in depth must be designed by a registered professional engineer in accordance with §1926.652(b) and (c).

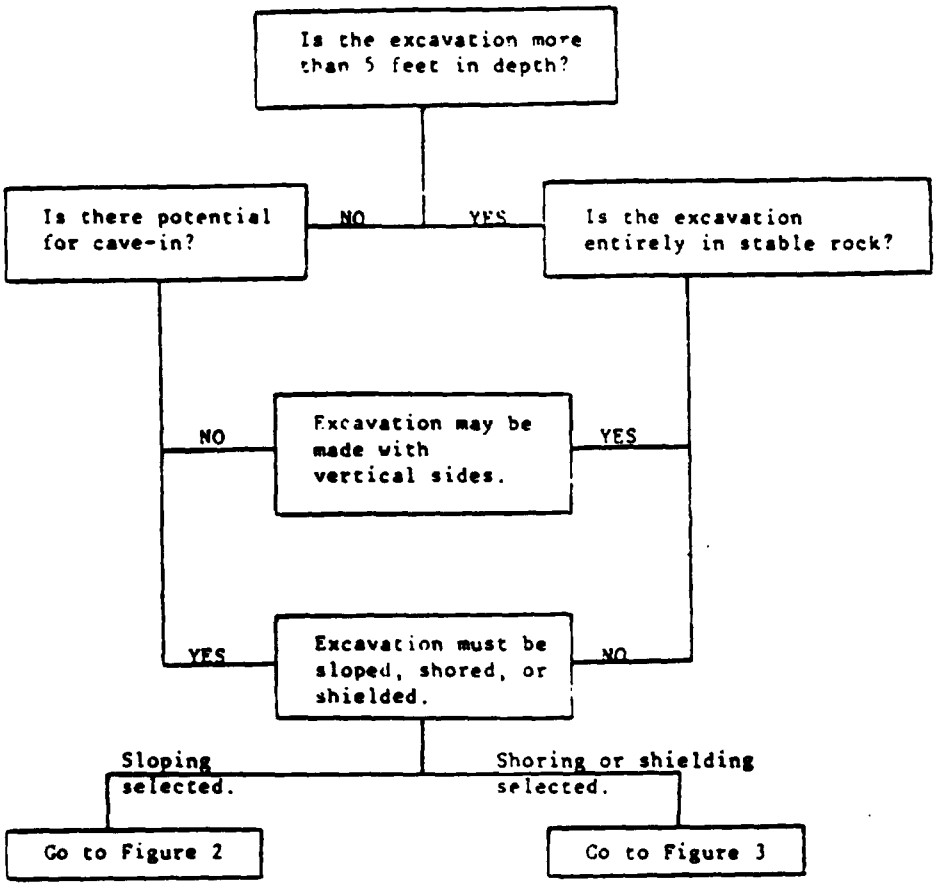


Figure 1—Preliminary Decisions

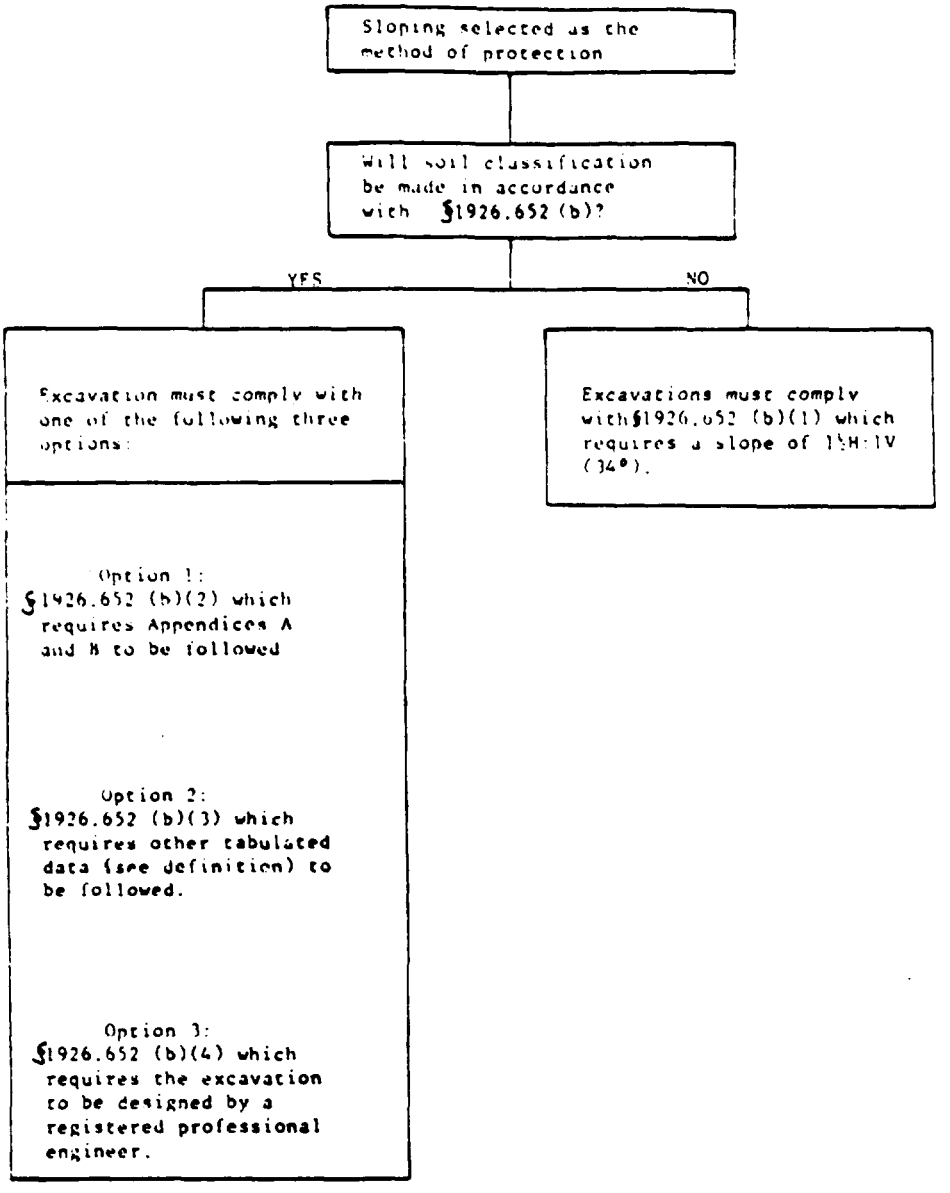


Figure 2—Sloping Options

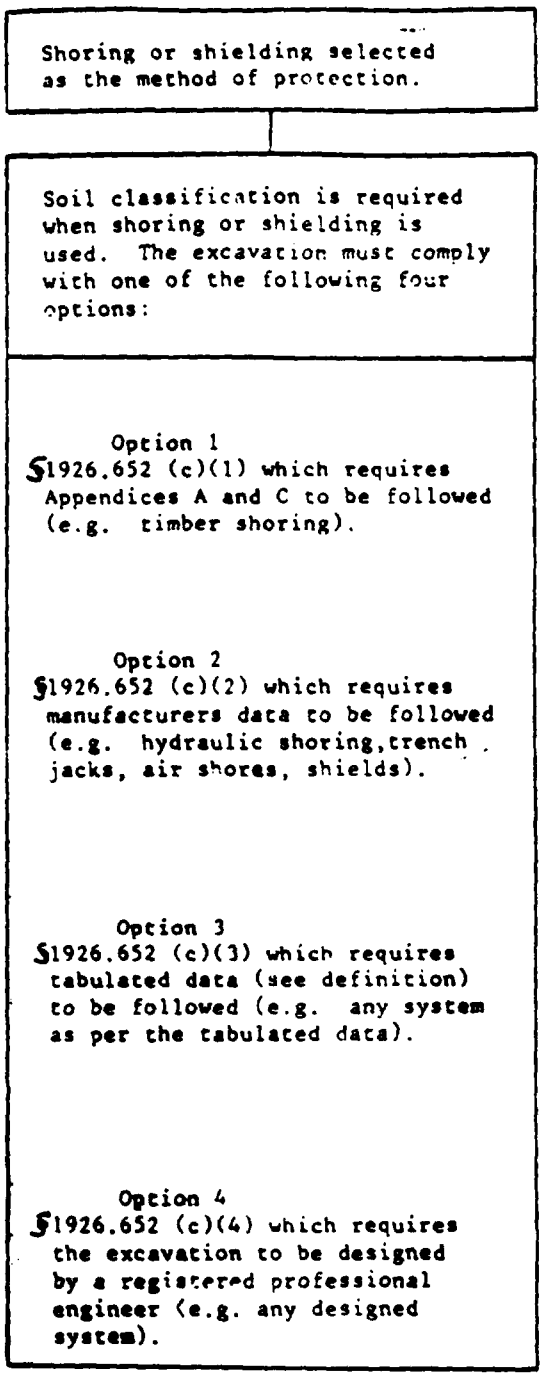


Figure 3—Shoring and Shielding Options

APPENDIX G

PROJECT FORMS

SAFETY INSPECTION CHECKLIST FOR EXCAVATIONS
29 CFR 1926 OSHA CONSTRUCTION STANDARDS

Activity: _____

Project: _____

Inspected By: _____ Date: _____

This checklist is to be used in addition to the basic project requirements.

Inspections must be made by the competent person when employee exposure can be reasonably expected:

A. Daily
B. At the start of work, and as needed throughout the shift
C. After every rainstorm or other hazard increasing occurrence

If the excavation is more than 20 feet deep, you must consult a registered professional engineer

Subject	Yes	No	N/A
1. Have all surface encumbrances (trees, boulders, etc.) been removed or supported to protect employees?			
2. Have the estimated locations of underground utilities been determined?			
3. Have the utility companies been called to locate underground utilities?			
4. Are the underground utilities supported, removed, or protected to safeguard employees in an open excavation?			
5. Have structural entry/exit ramps been designed by a competent person?			
6. Have structural entry/exit ramps for equipment been designed by a person qualified in structural design?			
7. Are ramps at a 45° angle (1:1) or less?			

Subject	Yes	No	N/A
8. Are means of exit provided for employees every 25 feet or less?			
a. Do ladders used in the excavation or within shields for entry/exit extend at least 3 feet above grade level?			
9. Are employees exposed to vehicular traffic wearing warning vests?			
10. Are employees prohibited from working under material being handled over the excavation, or working where material is being unloaded into the excavation?			
11. Are stop-blocks, other barriers, or hand signals used to warn equipment operators of the edge of the excavation?			
12. Are tests performed where a hazardous atmosphere may be reasonably expected to exist?			
a. Are tests performed before employees enter excavations more than 4 feet deep where a hazardous atmosphere or oxygen deficiency (atmosphere containing less than 19.5 percent oxygen) exists, or could be reasonably expected to exist? (This may occur in areas such as, but not limited to: deep excavations; sewer, gas, and water line excavations; excavations near utility lines, landfills, and areas where hazardous substances are stored nearby. Testing should at least include tests for oxygen level and explosive atmospheres.)			
b. Are adequate precautions, such as proper respiratory protection or ventilation according to Subparts D and E of the OSHA Construction Standards (OSHA 1926.50-1926.107), taken to prevent employee exposure to: atmospheres containing less than 19.5 percent oxygen, a concentration of a flammable gas in excess of 20 percent of the lower flammable limit of the gas, or other hazardous atmospheres?			
c. Are tests performed as often as necessary throughout the day to ensure that the atmosphere remains safe?			
13. Is emergency rescue equipment, such as breathing apparatus, a safety harness and line, or a basket stretcher, available where a hazardous atmosphere exists, or may reasonably be expected to develop? (This equipment shall be attended when in use.)			
14. Are employees entering bell-bottom pier holes or similar deep and confined excavations wearing a harness and lifeline?			
a. Is the lifeline individually attended while the employee is in the excavation?			
15. a. Are employees prohibited from working in excavations where water has accumulated, or is accumulating unless protection from the water is provided?			
b. Is the water removal equipment and operations monitored by a competent person?			

Subject	Yes	No	N/A
c. Are excavations protected from water accumulation by diversion ditches or dikes?			
d. Are excavations that have had water accumulation inspected by a competent person? See 15(a), (b), and (c).			
16. Are adjoining buildings, walls, and structures protected with adequate support systems for their stability and protection of employees?			
17. Are excavations below the base of any foundation or retaining wall that could pose a hazard to employees not permitted except:			
a. Where a support system, such as underpinning, is being used.			
b. Where the excavation is in stable rock.			
c. Where a registered professional engineer has determined that the structure is far enough away from the excavation that no protection is needed.			
d. Where a registered professional engineer had determined the work will pose no hazard to employees.			
18. Has a support system or other means of protection been provided where sidewalks, pavement, or structures been undermined by the excavation?			
19. Are employees in the excavation protected from loose rock or soil?			
20. Are spoil piles kept at least 2 feet from the edge of the excavation?			
21. Are inspections carried out by a competent person?			
a. Daily?			
b. Prior to, and during each shift as needed?			
c. After a rain, or other hazard increasing occurrence?			
22. Are employees removed from the excavation when the competent person finds evidence of a dangerous condition, or foresees a hazard developing?			
23. Are walkways or bridges over the excavation provided with standard guardrails?			
24. Are unattended excavations provided with barriers or other physical protection?			
Sloping Options			
25. If soil has not been classified according to 1926.652(b), is the excavation sloped to 1 1/2H:1 V?			
26. If the soil has been classified:			
a. Has the slope been determined by using Appendices A and B?			
b. Is the design determined by a registered professional engineer?			
c. Is the design determined by a registered professional engineer?			

Subject	Yes	No	N/A
Shoring and Shielding Options			
27. Has the soil been classified before proceeding? (REQUIRED)			
28. Have designs for using timber shoring been developed?			
29. a. Have designs for hydraulic shoring, trench jacks, air shores, or shields been developed using the manufacturer's tabulated data?			
b. Has any modification to the equipment been approved by the manufacturer?			
c. Has any damaged equipment been inspected and certified for service by the manufacturer, registered professional engineer, or competent person?			
d. Is the manufacturer's data onsite during construction of the support system and available to OSHA upon request?			
30. Is the system designed using other tabulated data or by a registered professional engineer?			
a. Is the data available onsite during construction of the protective system and available to OSHA upon request?			
31. Are support systems installed in a manner that does not pose a hazard to employees?			
32. Are employees protected during removal of support systems?			
33. Does removal of protective systems begin at the bottom of the excavation?			
34. Are employees prohibited from working on the face of a sloped or benched system above other employees except when those below are adequately protected?			
35. Are loads imposed on shields kept within the rated capacity of the shield?			
36. Are shields installed in a manner that restricts their movement?			
a. Do shields used in a trench with a sloped upper portion and vertically sided lower portion extend at least 18 inches above the vertical side?			
37. Are employees protected from hazards when entering or exiting shields?			
38. Are employees restricted from being inside a shield when the shield is being installed, removed, or moved vertically?			
Soil Classification			
39. Has the soil been classified by a competent person?			
40. Has at least one visual and one manual test been done?			
41. Are layered system classified by their weakest layer, except where a more stable layer lies under a less stable layer?			

Subject	Yes	No	N/A
42. Is the soil retested and, if necessary, reclassified if the conditions of the excavation change?			
a. Have large or long excavations been tested throughout their length to determine if soil classification changes?			
Training			
43. Is there an excavation safety program in effect on the jobsite?			
44. Have employees been instructed on the recognition and avoidance of excavation hazards and on the requirements of the standards?			

INCIDENT NARRATIVE

Incident involved:

1. _____ First aid
   _____ Environmental release
   _____ Property damage
   _____ Near miss

2. Any personnel involved? _____ If so, who?
   _____
   Job Title/Function? _____
   How long employed? _____

3. Provide brief narrative of incident/suspected cause.

   _____

   _____

   _____

   _____

4. Divisional Health and Safety Representative Evaluation:

   Detail causes of incident.

   _____

   _____

   _____

   Recommendations to prevent recurrence.

   _____

   _____

   _____

SAFETY INSPECTION REPORT

Division/Subsidiary: _____

Date: _____

Customer: _____

Time: From: _____ To: _____

Job Location: _____

Supervisor: _____

Foreman/Leadman: _____

General Job Description: _____

Employees: _____ _____

_____ _____

_____ _____

_____ _____

_____ _____

Safety/Housekeeping: _____

Submitted by:

_____ _____

Job Supervisor/Foreman/Leadman (Print)

Signature

DAILY SAFETY MEETING

Division/Subsidiary: _____ Facility: _____
Date: _____ Time: _____ Job Number: _____
Customer: _____
Specific Location: _____
Type of Work: _____
Chemicals Used: _____

SAFETY TOPICS PRESENTED

Protective Clothing/Equipment: _____
_____
Chemical Hazards: _____
_____
Physical Hazards: _____
_____
Summary of Work: _____
_____
_____
_____
_____
Other: _____
_____
_____

ATTENDEES

Name Printed	Signature

Meeting Conducted By:

_____ _____
Name Printed Signature
Supervisor: _____ Manager: _____

HEALTH AND SAFETY DAILY REPORT

_____
Project Name

Report Number: _____ Date: _____

A. Operation(s) Performed	**Approx. Time Spent (1/2 Hour)**
1. _____	_____
2. _____	_____
3. _____	_____
4. _____	_____
5. _____	_____

B. Crew Names and Titles	**Coveralls**	**Gloves**	**Respirator**
1. _____	_____	_____	_____
2. _____	_____	_____	_____
3. _____	_____	_____	_____
4. _____	_____	_____	_____
5. _____	_____	_____	_____

C. Monitoring Equipment Used	**Range**	**Average Reading**
1. _____	_____	_____
2. _____	_____	_____
3. _____	_____	_____
4. _____	_____	_____
5. _____	_____	_____

Note: Please ensure that the items listed in Sections B and C correspond to the operation number listed in Section A. Use additional sheets if necessary.

D. Environmental Conditions

Wind Speed	_____
Wind Direction	_____
Temperature	_____
Other	_____

TRAINING DOCUMENTATION				
Employee Name	Date of 40-Hour Introductory Training	Date of Last 8-Hour Refresher	Date of Supervisory Training if applicable	Date of Site-Specific Training Session (to be completed by HSO)

_____ certifies that the above information is accurate for all personnel.

_____

Signature of HSO

_____

Date

MEDICAL DATA SHEET

Name: _____ Home Telephone: _____

Address:

_____

Age: _____ Height: _____ Weight: _____

Next of Kin: _____ Telephone: _____

Drugs or Other Allergies: _____

_____

_____

Previous Illnesses or Exposure to Hazardous Substances: _____

_____

_____

Current Use of Medication (prescription and non-prescription): _____

_____

_____

Medical Restrictions: _____

_____

_____

Any Other Pertinent Data: _____

_____

_____

Name/Address/Telephone Number of Personal Physician: _____

_____

_____

The purpose of this form is to provide information to the attending physician in the event of an incident or occupational exposure. As such, it must be completed prior to field work and must accompany the injured/ill person to the emergency facility.

Permit Number _____

HOT WORK PERMIT

Location and Description of Hot Work _____

Purpose of that Work _____ Date _____

AWD Project Number _____ Time _____

Expiration _____

Person in Charge of Hot Work _____

Personnel performing that work:

Personnel Assigned	Duties

SPECIAL INSTRUCTIONS ____ None _____

_____

____ Check with issuer before beginning work

HAZARDOUS MATERIAL

____ None ____ Hydrogen Sulfide ____ Carbon Monoxide ____ Benzene
____ Hot Material ____ Aromatic Oil ____ Acid/Caustic
____ MEA ____ Asbestos ____ Other _____

TESTS TO BE TAKEN

	Yes	No	Action Level or PEL if applicable	Initial Reading	Any Elevated Readings
% O_2	___	___	___	___	___
% LEL	___	___	___	___	___
PID	___	___	___	___	___
FID	___	___	___	___	___
Specific Colorimetric Tubes	___	___	___	___	___

Person performing monitoring _____

Monitoring frequency and frequency justification _____

_____

FIRE PROTECTION

____ None ____ Water Hose and Nozzle ____ Fog Spray ____ Fire Extinguisher
____ Fire Watch Required ____ Other: (specify) _____

CONDITION OF AREA AND EQUIPMENT	YES	NO	NA	THESE KEY POINTS MUST BE CHECKED
	___	___	___	1. Lines disconnected and blanked away or, where disconnecting is not possible, blinds installed in the prescribed manner.
	___	___	___	2. Equipment depressured and drained.
	___	___	___	3. Equipment or area satisfactorily clean of oil or other combustible material.
	___	___	___	4. Manhole plates, catch basins, and sewer connections satisfactorily covered and sealed.
	___	___	___	5. Adjoining equipment and operations considered OK from standpoint of their possible effect on this job and concerned parties notified if overlapping work conditions exist.
	___	___	___	6. Electrical equipment disconnected / racked out / tagged out by _____.

Permit Prepared By: _____ HSSO _____ Date

Permit Reviewed By: _____ TEAM LEADER _____ Date

Permit Approved By: _____ SITE MANAGER _____ Date

Permit Number _____

CONFINED SPACE/LIMITED EGRESS PERMIT

Location and Description of Work _____ Date _____
Purpose of Entry _____ Time _____
Office _____ Expiration _____
Person in Charge of Work _____

Personnel Assigned	Duties

SPECIAL REQUIREMENTS	YES	NO		YES	NO
Lock Out - De-energize	___	___	Escape Harness	___	___
Lines Broken - Capped or Blanked	___	___	Tripod Emergency Escape Unit	___	___
Purge - Flush and Vent	___	___	Lifelines	___	___
Ventilation	___	___	Fire Extinguishers	___	___
Secure Area	___	___	Lighting	___	___
Breathing Apparatus	___	___	Protective Clothing	___	___
Resuscitator - Inhalator	___	___	Respirator	___	___

			Depth and Reading					
Tests To Be Taken	Yes	No	Initial	4'	8'	12'	16'	20'
% O_2	___	___	___	___	___	___	___	___
% LEL	___	___	___	___	___	___	___	___
PID	___	___	___	___	___	___	___	___
FID	___	___	___	___	___	___	___	___
Specific Colorimetric Tubes								
_____	___	___	___	___	___	___	___	___
_____	___	___	___	___	___	___	___	___
_____	___	___	___	___	___	___	___	___

Person performing monitoring _____
Monitoring Frequency and Frequency Justification _____

INSTRUMENTS USED	Name	Type	Ident. No.

SAFETY STANDBY PERSON(S)

_____
_____

Permit Prepared By: _____ _____
HSSO Date

Permit Reviewed By: _____ _____
TEAM LEADER Date

Permit Approved By: _____ _____
SITE MANAGER Date

RESPIRATOR FIT TEST WORKSHEET

EMPLOYEE NAME: _____ SOCIAL SECURITY NO. _____

AWD OFFICE: _____ SITE LOCATION: _____ TEST DATE: _____

	RESPIRATOR 1	RESPIRATOR 2	RESPIRATOR 3
EQUIPMENT TYPE:			
MANUFACTURER'S NAME:			
MODEL:			
SIZE:			

TEST RESULTS	RESPIRATOR 1	RESPIRATOR 2	RESPIRATOR 3
(1) Negative Pressure Test	P ( ) F ( )	P ( ) F ( )	P ( ) F ( )
(2) Positive Pressure Test	P ( ) F ( )	P ( ) F ( )	P ( ) F ( )
(3) Isoamyl Acetate Vapor Test	P ( ) F ( )	P ( ) F ( )	P ( ) F ( )
(4) Irritant Smoke Test	P ( ) F ( )	P ( ) F ( )	P ( ) F ( )

Employee briefed on fundamental principles of respiratory protection, use, inspection, cleaning, maintenance, and storage of equipment.

Yes ( ) No ( )

ADDITIONAL INFORMATION

Most recent employee physical examination conducted on _____

Corrective lenses required for normal work tasks Yes ( ) No ( )

Facial characteristics preventing seal (beard, missing dentures, etc.)? Yes ( ) No ( )

I hereby certify that the subject employee has been FIT tested according to procedures specified in AWD SOP HS2.1, Appendix A. The results of the test indicate that the subject employee is accepted ( ) rejected ( ) for work assignments requiring respiratory protective devices.

_____ _____ _____

Examiner's Name (Please Print) Examiner's Signature Date

_____ _____

Employee's Signature Date

INCLUDE OSHA FORM 200

EMPLOYEE INJURY/ILLNESS REPORT

This is an official document to be initiated by the employee's supervisor. Please answer all questions completely. This report must be forwarded to the HSSO, DHSR, CHSM, and Personnel within 48 hours of the incident.

Injured's Name _____ Sex ____ S.S. No. _____ Birth Date _____

Home Address _____ City _____ State ____ Zip _____ Phone _____

Job Title _____ Employee No. _____ Hire Date _____ Hourly Wage _____

SUPERVISOR

Date of Incident _____ Time _____ Time/Reported _____ To Whom _____

Client Name _____ Client Address _____ Time Shift Began _____

Exact Location of Incident _____ Did Employee Leave Work? ☐ No ☐ Yes When _____

Has Employee Returned to Work? ☐No ☐Yes When ____ Did Employee Miss a Regular Scheduled Shift ☐No ☐Yes

Doctor/Hospital Name _____ Address _____

Witness Name(s) _____ Statements Attached? ☐ No ☐ Yes

Nature of Injury _____ Exact Body Part _____
(Attach Doctor's Report)

Medical Attention: ☐ None ☐ First Aid Onsite ☐ Doctor's Office ☐ Hospital E/R ☐ Hospitalized

Job Assignment at Time of Incident _____ Job _____ Phase _____ Task _____ Subtask _____

Describe Incident (Use separate sheet if necessary) _____

What was the Employee doing when the Incident Occurred? _____

What Object, Substance, Machine, or Tools were Directly Involved in the Incident _____

What Unsafe Physical Conditions or Unsafe Act Caused the Incident? _____

What Corrective Action has been Taken to Prevent Recurrence? _____

Supervisor/Foreman _____ _____ _____
(Print) Signature Date

PROJECT MANAGER

Comments on Incident and Corrective Action _____

Project Manager's Name _____ _____ _____
(Print) Signature Date

HEALTH AND SAFETY SITE OFFICER

Concur with Action Taken ☐ No ☐ Yes Remarks _____

OSHA Classification

☐ Incident Only ☐ First-Aid ☐ No Lost Workdays ☐ Lost Workdays ☐ Restricted Activity ☐ Fatal

Days Away From Work _____ Days Restricted Work _____ Total Days Charged _____

Name: _____ _____ _____
(Print) Signature Date

HEALTH AND SAFETY PLAN COMPLIANCE AGREEMENT

I, _____ (print name), have received a copy of the Health and Safety Plan for the ECC Site (Project No. _____). I have read the plan, understand it, and agree to comply with all of its provisions. I understand that I could be prohibited from working on the project and may be subject to disciplinary actions for violating any of the safety requirements specified in the Health and Safety Plan for conducting myself in an unprofessional manner.

_____

Name (Print)

_____ _____

Signature Date

PHYSICIAN'S STATEMENT

Home Office Location _____

Participant Name: _____ Date of Exam: _____

Part A

The above-named individual has:

1. Undergone a physical examination in accordance with OSHA Standard 29 CFR 1910.120, paragraph (f) and found to be medically-

   ( ) qualified to perform work on hazardous waste sites
   ( ) not qualified to perform work on hazardous waste sites

   and,

2. Undergone a physical examination as per OSHA 29 CFR 1910.134(b)(10) and found to be medically-

   ( ) qualified to work in respiratory protection
   ( ) not qualified to work in respiratory protection

Part B

I, _____, have examined _____ Physician's Name
(print) Participant's Name (print)

and have determined the following information:

1. Results of the medical examination and tests (excluding findings or diagnoses unrelated to occupational exposure):

   _____

   _____

   _____

2. Any detected medical conditions which would place the employee at increased risk of material impairment of the employee's health:

   _____

   _____

PHYSICIAN'S STATEMENT
PAGE TWO

3. Recommended limitations upon the employee's assigned work:

_____

_____

_____

_____

I have informed this participant of the results of this medical examination and any medical conditions which require further examination or treatment.

Based on the information provided to me, and in view of the activities and hazard potentials involved in hazardous waste site work, this participant

( ) may
( ) may not

perform his/her assignment task. This clearance for work is conditional until all laboratory data has been received and reviewed. Any results which indicate a limitation on this employee's ability to perform his/her assignment will be immediately brought to the attention of the employee and the CHSM.

Physician's Signature _____

Address _____

Telephone Number _____

NOTE: Copies of test results are maintained and available at:

_____
Address